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DESIGN AND EVALUATION OF AN AUTOMATED OXYGEN UPTAKE RATE MEASUREMENT SYSTEM AT THE EDMONTON SEWAGE TREATMENT PLANT

by

©

BIJAN AIDUN

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF SCIENCE

DEPARTMENT OF CIVIL ENGINEERING

EDMONTON, ALBERTA

FALL 1986

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Daniel W Smith

Supervisor

V. G. Gowrishankar

Date 12 June 86

Dedication

TO MY MOTHER, AND FATHER.

To Whom I Owe Everything.

ABSTRACT

Activated sludge wastewater treatment consists of a biological and a physical system. In this process the waste materials are stabilized in an aerobic biological stage during which microorganisms utilize the complex organics as a food source. The rate at which oxygen is consumed by the microorganisms during this process is known as the Oxygen Uptake Rate (OUR) of the mixed liquor. Continuous monitoring of this parameter has been ackowleged by various researchers to be an excellent tool in the control of the treatment process. Some of the advantages and the importance of continuous Oxygen Uptake Rate measurement in controlling an activated sludge treatment process are studied.

In this research an Automated Oxygen Uptake Rate Measuring System was designed and evaluated. This system has been submitted for patenting.

The Automated Oxygen Uptake Rate measurement system with the aid of a micro-computer is capable of automatically collecting a volume of sample and measuring its OUR value and repeating the task on a continuous basis. The collected data are then stored by the system for future study or immediate control of the treatment process.

The designed automated OUR measurement system was evaluated through three different testing programs. First was a series of calibration tests through which the system was calibrated and the accuracy of its measurements were confirmed. Second, was the long term operation or field experience. During this testing schedule the apparatus was continuously operated at the Edmonton Wastewater Treatment Plant for a period of six months. The long term continuous monitoring feature of the system was confirmed during this period. Finally a better understanding of the performance of the system was provided by operating it in conjunction with the collection of samples which were analyzed for their filtered and unfiltered BOD, suspended solid, and volatile suspended solids measurements.

The OUR system proved to be reliable in automatically collecting a volume of sample and measuring its OUR value. It can also withstand long term continuous testing periods. This totally automated OUR measurement system is recommended to be used as an on-line continuous monitoring unit in an activated sludge treatment plant to assist the operator in controlling the treatment process.

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1. Introduction

The Activated sludge treatment process is the most common wastewater treatment technique used in large cities. During this biological treatment process, the biodegradable organics in the wastewater are absorbed and metabolized by the available microorganisms in an aerobic environment. Flocs are then formed in this process and are separated from the liquid in a clarifier or settling tank.

In the seventy years of its history the basic concept of activated sludge treatment has been modified and changed to improve treatment efficiency, satisfy new conditions of loading, and to reduce construction costs. However, the controllable elements of this process have not changed. These elements include aeration, rate of return sludge and concentration of mixed liquor suspended solids. One parameter which has been acknowledged by researchers to be an excellent tool in monitoring and controlling the activated sludge treatment process is the rate at which oxygen is consumed by the microorganisms during their metabolism of waste. This oxygen uptake rate (OUR) measurement of the activated sludge mixed liquor reflects the microbial activity and the general condition of the treatment process.

Automatic and periodic measurement and monitoring of this parameter has not been possible up until today. Manual OUR measurements consume a great deal of time and manpower. Therefore, plant engineers and operators have not been able to take advantage of this valuable monitoring parameter to adjust and control the treatment process to operate at its optimum. Up until now, to compensate for this lack of OUR measurements, dissolved oxygen (DO) of the aeration tank is monitored and controlled so as to not drop below the minimum level of 1.5 to 2 mg/L.

Acknowledging the importance and advantages of on-line OUR measurement in an activated sludge treatment process and a need for a automatic monitoring unit triggered this research. A main goal of this study is to design and develop an automated OUR measuring system to monitor the OUR values of an activated sludge treatment process on a routine basis. To develop such a system a combination of electrical, mechanical, and computer systems were considered in the design. After studying the alternatives and the preliminary design, the successful design was built and put into operation and evaluated for its capabilities.

1.1 Objectives

The objectives of this study were:

1. To design an automated oxygen uptake rate measurement system which collects a volume of sample, measures its OUR value according to Standard Methods on a routine basis.
2. To evaluate the OUR system through experimental test runs and field operation.
3. To evaluate the importance and advantages of routine OUR

measurement in an activated sludge treatment process from the field tests.

1.2 Scope

The main thrust of this study was to design an automated oxygen uptake rate monitoring system which is capable of routinely measuring the OUR value of the mixed liquor. To achieve this goal a literature survey was carried out to point out the importance and advantages of OUR measurement in monitoring and controlling an activated sludge treatment process and also to identify the existence of any previously designed automated OUR measuring systems.

To design the automated OUR measuring system two preliminary designs of the apparatus were considered. After reviewing the alternatives the successful design was built and put into operation. Through experimental runs and field operation with the system this apparatus was evaluated. This research consists of three segments.

1. Literature review to point out the need for automatic OUR measuring system.
2. Design and study of preliminary alternatives. A successful design was built and put into operation.
3. Evaluation of the designed system by experimental runs and testing at the Edmonton Wastewater Treatment Plant for a period of six months.

2. Activated Sludge Process And Control Parameters.

2.1 Introduction To The Activated Sludge Process.

An activated sludge wastewater treatment process was first developed in England in 1914 by Ardern and Lockett. This process is a continuous aerobic method of biological wastewater treatment under aerobic conditions. The treatment process is based on the aeration of wastewater, which causes a flocculating biological growth, followed by separation of this growth from the treated wastewater. Part of the growth is then wasted, and the remainder is returned to the system.

The process of activated sludge treatment is made up of two systems. One is a biological system, under which the waste matter is stabilized in an aerobic environment. Second is a physical system, where the flocculated solids are separated from the liquid. In its conventional form activated sludge process consists of a reactor (often called the aeration basin) and a settler tank or clarifer.

The stabilization of waste material in an activated sludge process is a result of the micro-organisms utilizing complex organics as a food source in an oxygen rich environment. The micro-organisms consume organic material to produce energy and new cells. In the process they utilize oxygen and release carbon dioxide (CO_2) and water. The basic mechanism of the biological utilization process can be represented by the following biological reaction:

$$\text{Organic Material} + \text{Micro-organisms} + \text{Oxygen} \longrightarrow \text{Micro-organisms} + CO + H_2O + \text{Energy}$$

Large masses of micro-organisms are generated through the utilization of organic substrates. These masses of micro-organisms are then settled by gravity, and clean water is separated from the biomass. The settled micro-organisms are referred to as sludge. Part of the sludge is then wasted (taken out of the system), and the remainder is recycled through the system to utilize the incoming organics. Figure 2.1 illustrates a basic activated sludge process system.

Over the years many versions of the original activated sludge process have been developed; however, fundamentally they are all similar. This method of wastewater treatment has become quite popular. The treatment process produces an effluent of high quality at a reasonable cost, and the treatment plant is small in size. Furthermore the process can be controlled to an extent, through the adjustment of aeration time, aeration intensity, sludge age, organics to microorganism mass ratio, and other parameters, to obtain a desirable effluent quality.

2.1.1 Factors Affecting The Activated Sludge Process.

There are many factors which affect the process of an activated sludge treatment, thus causing variation in the treatment performance. The first and foremost of these

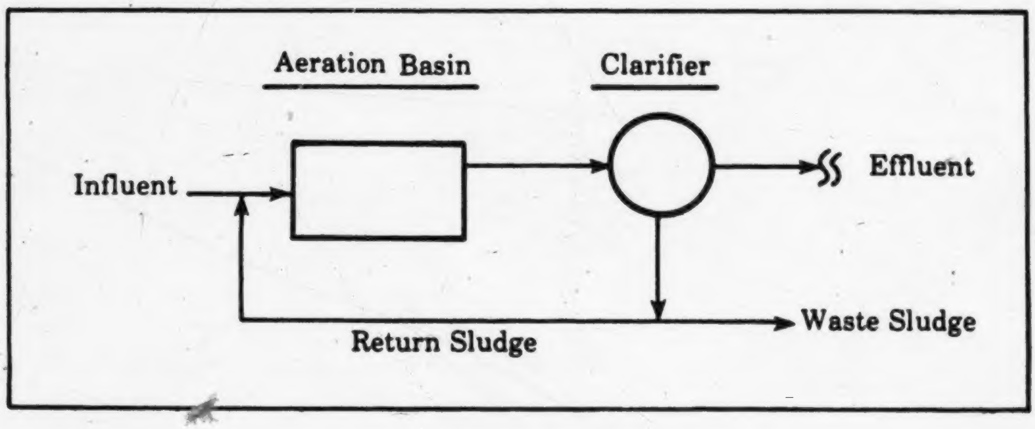
Aeration Basin
Clarifier
Influent
Effluent
Return Sludge
Waste Sludge

Figure 2.1 Activated Sludge Process Diagram.

factors is the natural variation of the influent wastewater. Fluctuation of the influent wastewater flow and quality parameters such as the concentration of organics, pH, temperature, and toxic materials, have an effect on both the biological and the physical processes of the activated sludge system. To consistently produce a high quality effluent under these variations, it is important to monitor their effects on the activated sludge process, and adjust the control parameters to accomodate them.

Oxygen uptake rate (OUR) of micro-organisms is one of the many parameters of the activated sludge process which has been suggested for use as a control parameter. This parameter has been acknowledged by various authors, to accurately reflect the microbial activity in the activated sludge process, and has been reported to be an excellent tool in the control of the activated sludge process (Blok, 1976; Benefield, et al., 1975; Mona, et al., 1979; Andrews, 1977; Huang and Cheng, 1984). OUR of micro-organisms in the mixed liquor activated sludge is quite sensitive to process changes, and it reflects the capacity and the rate of organic utilization of the microbes under various operating conditions (Hang and Cheng, 1984).

2.1.2 Biological Systems of the Activated Sludge Process.

The biological metabolism of organics in the activated sludge process consists of micro-organisms utilizing the organics matter as food for generating energy and new organisms. During the process, oxygen is utilized and CO_2 is produced. This appears to be a simple process; however, in reality it is a complex series of many biochemical reactions which take place in or around each single cell, or microorganism. The basic components of a bacterial cell are shown in Figure 2.2. This figure illustrates, the steps through which a cell breaks down food into carbon dioxide and hydrogen to create energy.

The creation of energy by a cell is important in understanding the oxygen utilization of the biological system. A diagram showing a suggested route of cellular metabolism is shown in Figure 2.3. This is known as the Krebs Cycle which shows the circular path through which glucose is broken down by the release of carbon dioxide and high energy hydrogen ion ("H+") (Arthur, R.M 1982). The carbon dioxide is then discharged as waste and is not further utilized in the system. The high energy hydrogen atoms are transferred down a respiratory chain where the energy contained in the hydrogen ions is transferred to phosphate radicals to combine with adenosine diphosphate (ADP) creating adenosine triphosphate (ATP), a package of energy. The energy in ATP is utilized were it is needed, then it is converted back to ADP. The hydrogen ion which has lost its energy is then combined with oxygen to form water. Therefore, the oxygen uptake rate of a system is intimately related to the energy production of the cells, and their behaviour in the system. Oxygen acts as a hydrogen accepter, The Figure has been removed because of the unavailability of copyright permission. Please refer to the original source.

Figure 2.2 Synthesized Cell.(Arthur, R.M. 1981)

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Figure 2.3 Suggested route of cellular metabolism.
(Arthur, R.M. 1982)

after the high energy hydrogen ion has released its energy to be used by the cell. Hence, oxygen utilization of the activated sludge process can be used as a signal to indicate, the degree of activity in the biological system. A high value of oxygen uptake rate by the micro-organisms indicates that the micro-organisms are utilizing food in a satisfactory rate. On the other hand a low value of oxygen uptake rate indicates trouble in the biological system: either the micro-organisms are not utilizing food, or all the available food has been metabolized and the micro-organisms are undergoing endogenous respiration.

2.1.3 Oxygen Uptake Rate of Micro-organisms.

The rate at which oxygen is utilized by the micro-organisms in a sample of raw wastewater is shown in Figure 2.4 (Arthur, 1982). Four different stages of oxygen uptake rate are illustrated, including lag, a maximum rate of demand, a declining oxygen demand, and the endogenous demand. The rate at which oxygen is consumed by the micro-organisms is the indication of the system's biological characteristics.

The lag phase is a result of micro-organisms not being acclimated to the particular type of food present in the system. This phase can be eliminated if acclimated organisms are present, such ~~as~~ at the inlet of aeration tank in an activated sludge process. The maximum rate of oxygen demand indicates that the micro-organisms are quite active, and are

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Figure 2.4 Respiration of a sample of raw wasterwater. (Arthur, R.M. 1982)

metabolizing food at a desirable rate. The slope of the line at maximum demand rate is related to the quantity of available food and the viabilty of the micro-organisms. The declining oxygen demand phase occurs when micro-organisms are utilizing less easily decomposable organics, or when the quantity of food is decreasing. The endogenous demand phase indicates that the majority of the available food has been metabolized and the micro-organisms are using oxygen to oxidize the food stored within their cells.

There are two types of microbial respiration contributing to the total oxygen uptake rate of activated sludge mixed liquor; one is the exogenous and second is the endogenous microbial respiration. Exogenous respiration is the micro-organisms use of oxygen to utilize the substrate contained in the influent wastewater. This portion of the oxygen demand may be expected to fluctuate with the instantaneous changes in the influent waste loading. On the other hand the endogenous respiration is the oxygen uptake of micro-organisms to metabilize the substrates stored within their cell. This portion of the total microbial respiration changes gradually with the influent variations.

The behavior of micro-organisms in the activated sludge mixed liquor can be affected by the availability of dissolved oxygen (DO). If the DO in the aeration tank is too low, it will inhibit the activity of the micro-organisms; hence, reducing the substrate removal rate and the efficiency of the treatment plant. DO concentrations in the aeration tank which are too high are also not desireable because it is an indication that power is being wasted, since more oxygen is being supplied to the system than is needed by the micro-organisms. The range of DO concentration which guarantees a favourable living condition and is economical is between 0.5 and 2 mg/l (Schegel and Lomann, 1981).

2.2 Review Of Oxygen Uptake Rate.

2.2.1 Effects of Variable Loading On Oxygen Uptake Rate.

The relationship between the oxygen demand and the variation in influent waste loading was studied by Duggan and Cleasby (1976). An activated sludge pilot plant located at the Ames, Iowa water pollution control plant was monitored for six 24-hr test runs. The parameters monitored in all the six runs include, influent BOD_5 and TOC, mixed liquor DO, effluent BOD_5 and TOC, and the mixed liquor oxygen uptake rate. The specific oxygen uptake rates, (SOUR, mg O_2/(hr.g MLSS)) were calculated by dividing the measured specific oxygen uptake rate to the corresponding mixed liquor suspended solids (MLSS) concentrations. The relationship between these parameters, in one of their test runs, is illustrated in Figure 2.5.

Duggan and Cleasby (1976) concluded that, given DO concentrations greater than the values critical to the microbial survival, the oxygen uptake rate of mixed liquor

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Figure 2.5 Relationship of mixed liquor oxygen demand and influent fluctuation, Test run 4. Duggan and Cleasby (1976)

responds directly to the natural variations of the biodegradable organics in the influent. Figure 2.5, being similar to all of their test runs, illustrates the direct response of SOUR to the increased influent BOD_5 and TOC loadings. The inverse relationship of the mixed liquor DO and substrate loading is also evident.

The behavior of the specific oxygen uptake rate (SOUR) under step changes and square wave input in the feed flow and concentrations of a bench scale activated sludge process was studied by Mona et al. (1979). Through continuous monitoring of the specific oxygen uptake rate (SOUR) and dissolved organic carbon of the system, it was found that SOUR responded instantaneously to the step increase of, the substrate and hydraulic loadings. To accommodate the increase in the loadings, the specific substrate uptake rate of the system was also noted to increase. From these findings Mona et al. (1979) concluded that OUR of a system is closely related to the rate of substate utilization by the micro-organisms; which changes with organic loading.

To simulate the frequent characteristic changes of the influent wastewater, and monitor its effect on the system's SOUR, Mona et al. (1979) performed an experiment in which continuous square-wave disturbance of flow and/or substrate concentrations were entered to the reactor. Under these circumstances the SOUR of the system was found to respond very well to the changing substrate concentration. Thus the measurement of OUR and SOUR in the activated sludge provides a good indication of biological activity in the mixed liquor, and influent load variation.

The measurement of OUR and SOUR is an excellent means for detecting the slug or pulse input of toxic or rapidly biodegradable materials into the aeration basin. Toxic or inhibitory materials will cause the SOUR and OUR to decrease while a highly biodegradable wastes will cause an increase of the OUR and SOUR. Acomputer simulation of the dynamic response of the SOUR to a sudden injection of toxic material and biodegradable materials are shown in Figure 2.6 and 2.7, respectively. These responses to toxic and rapidly biodegradable materials indicate that SOUR should be used as an monitoring parameter to adjust the system in advance to over come these variations (Andrews, 1977).

2.2.2 Micro-organisms Viability and OUR of Activated Sludge.

Since activated sludge is a process of biochemical reaction of micro-organisms, the measurement of microbial activity (rate of substrate utilization) and viability (active microbial mass concentration) can be important in design and control of the process. Of several parameters which have been investigated by researchers to reflect the microbial activity and viability, the parameter of OUR of activated sludge appears to be very promising (Andrew, 1977; Giona and Annesini, 1979; Huang, Cheng, and Mueller, 1985; Mona _et al._, 1979; Walker and Davies, 1977; Young, 1981)

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Figure 2.6 Response of "SOUR" to a toxic pulse. (Andrews 1977)

Figure 2.7 Response of "SOUR" to substrate pulse. (Andrews 1977)

The ratio of active to inactive solids changes appreciably from plant to plant or with in a given plant depending on factors such as raw waste characteristics, wastewater temperatures, and biological solids retention time. Walker and Davies (1977) studied the effect of net growth rate on unit viability and on respiration rate of activated sludge shown in Figure 2.8. Both the viable cell counts and the respiration rate of the micro-organisms are increased with the net growth rate. These two parameters reach their maximum values at about the net growth rate of 0.9 day^{-1}. These results compare favourably with findings of Weddle and Jenkins (1971), who also find a similar relationship between the unit viability, respiration rate and the net growth rate.

However, Walker and Davies (1977), contradicting Weddle and Jenkins (1971), concluded that the respiration rate per viable cell is not constant over the range of the net growth rate. Experiments show viable cells respire more than six times faster at a net growth rate of 0.1 day^{-1} than at a net growth rate of 2.7 day^{-1}. These experiments prove that viable bacteria are not totally responsible for the total OUR of activated sludge process. A portion of the respiration activity can be attributed to the dying or the non-viable cells (Walker and Davies, 1977). Many authors have reported that a cell's loss of viability is not necessarily associated with its loss of biochemical activity.

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Figure 2.8 Effect of net growth rate on unit viability o, and respiration rate ●. (Walker and Davies 1977)

Microbial viability as determined through respiratory activities is slightly higher than measured by other techniques such as plate counting. This is because the loss of multiplication is not necessarily associated with loss of biochemical activity (Huang, Cheng, and Mueller; 1985). These authors suggested the use of SOUR measurement for reporting the microbial viability of activated sludge sample.

Through some assumptions the respiration activity of the viable bacteria was calculated by Walker and Davies (1977). This value was then subtracted from the total respiration activity of the system to estimate the respiration activity of non-viable bacteria. Figure 2.9 shows the distribution of respiratory activity of viable and non-viable bacteria at different growth rates. At the growth rate of 0.1 day^{-1} over 80% of the total respiration can be attributed to the non-viable bacteria.

2.2.3 Oxygen Uptake Rate as an Activated Sludge Control Parameter.

Hass (1979) reviewed several control parameter of activated sludge process and proposed the use of oxygen uptake rate (OUR) of micro-organisms as an effective control parameter. The use of this reagentless measurement can be adopted readily for on-line automatic measurement. Base on the mass balance in a complet-mix activated sludge treatment system, with sludge wasting from the aeration tank, Hass

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Figure 2.9 Distribution of respiratory activity between viable ● and non-viable o, bacteria at different growth rates. (Walker and Davie 1977)

developed a theoretical equation (Eq. 1) relating the effluent soluble substrate concentration of the process to the OUR values of the aeration tank MLSS.

$$S = S_0 - (\theta * OUR)(1 + 1/(\theta_s * k_d)) \qquad (1)$$

S= Effluent soluble substrate concentration, mg/L
S_0= Influent soluble substrate concentration, mg/L
OUR= Aeration tank oxygen uptake rate, mg/(L.h)
θ= Wastewater hydraulic retention time, h
θ_s = Solid retention time, h
k_d = Endogenous decay coefficient, h^{-1}

Through this equation the desired OUR of a system, for a given hydraulic residence time and influent substrate concentration, can be calculated to achieve a target effluent soluble substrate concentration. This equation was never evaluated through experimental tests.

Eckenfelder and Jaffe (1982) developed a similar type of equations relating the activated sludge plant performance to the specific oxygen uptake rate (SOUR). This relationship was validated through laboratory experiments using synthetic substrates in activated sludge units.

Andrews (1977) suggested that controlling the SOUR of a activated sludge system would automatically result in the control of the specific growth rate, F:M ratio, and sludge age of the system. The SOUR can be maintained at a constant value at which a satisfactory removal of pollution is obtained. Through constant measurement of SOUR, any sudden upset to a system can quickly be detected and acted upon.

It is frequently necessary to analyze variation of incoming waste to predict potential deleterious effects on the activated sludge biological treatment system. The measurement and control of toxic compounds is among one of the least understood and most important areas of biological waste treatment. The biological effects of toxic waste are difficult to monitor closely with the standard wastewater analyses like BOD. Patterson (1971) suggested the adoption of more sensitive parameters of biological or biochemical activity for this type of analyses. Oxygen respiration rate was one of the three biochemical activities studied by Patterson to be adopted in a biological waste treatment system as a toxic indicator. This parameter was found to be sensitive to low concentrations of toxicants. The inhibition of activated sludge oxygen uptake caused by toxic compounds such as hexavalent chromium and divalent nickel were monitored. The test results showed that chromium caused a linear inhibition on oxygen uptake rate, while the nickel inhibition pattern was curvilinear and much more severe. From this study Patterson concluded that measured oxygen uptake inhibition caused by a toxicant, is a function of not only the toxic concentration but also a function of the sludge physiological condition and the contact time between the sludge and the toxicant.

According to Hass (1979) the OUR measurement of activated sludge can be used as an indicator to determine the presence of toxic substrates. This activity parameter can be determined rapidly, and adjusted to compensate for variation in the process caused by changes in the influent waste strength, influent flow rate, or the presence of toxic materials. OUR of micro-organisms was found to be responsive to the toxic compounds, such as heavy metals, copper, nickel, and phenol, which may be present in the influent wastewater.

2.2.4 OUR Not an Indicator of Effluent Quality.

Contravening opinions are found in the literature regarding use of DO and OUR as effluent quality control parameters. Most, however, agree that both DO concentrations and OUR in the aeration basin directly relate the response of the microoganisms to the variation ~~in~~ influent loading. Edwards and Sherrard (1982) suggested that variation in the OUR for a changing influent flow and organic loading does not necessarily indicate a change in the effluent quality as measured by BOD and COD. They stated that, OUR can not be used as a control parameter for the ~~activated~~ sludge process when treating a highly variable influent quantity and quality flow. Figure 2.5 (Duggan and Cleasby, 1976) illustrates a highly variable and fluctuating OUR with little or no change in effluent quality.

2.3 Present Oxygen Uptake Measurement Models.

2.3.1 Standard Methods

To measure the oxygen uptake rate of an activated sludge sample, an appropriate volume of an oxygen rich sample is placed in a bottle (usually a 300 ml BOD bottle is used). The dissolved oxygen measurements of the sample is carried out in an enclosed environment while the sample is agitated. The drop in the dissolved oxygen (DO) is measured with respect to time. By plotting the DO vs time on arithmetic graph paper a straight line should result, the slope of which represents the OUR of the sample.

2.3.2 Respirometer.

Respirometer is one of the basic devices used to measure the oxygen uptake rate of micro-organisms. Otto Warburg in 1926 first came up with the idea which is the basis of the manufactured devices today. A diagram of the automated model of the activated sludge respirometer is shown in Figure 2.10.

The units operation requires that a sample of MLSS be placed in the aeration column and then the column sealed from the outside environment. An air compressor circulates a

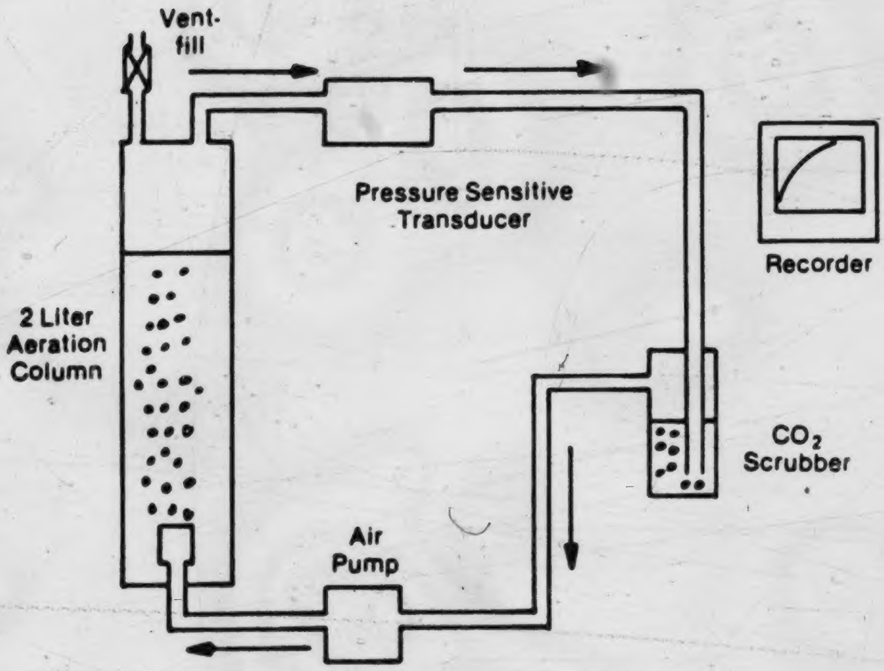

Vent-
fill
Pressure Sensitive
Transducer
Recorder
2 Liter
Aeration
Column
CO_2
Scrubber
Air
Pump

Figure 2.10 Automatic Respirometer.

fixed volume of air through an air diffuser to provide, oxygen supply and mixing to the column. As oxygen is utilized by the micro-organisms, carbon dioxide (CO_2) is produced. The off-gas from the column is then circulated through a potassium hydroxide (KOH) solution, where CO_2 is immediately removed. The net effect is a decrease in the volume of gas. The system's pressure is continuously monitored and recorded by a transducer. The output from the transducer serves as a continuous representation of the oxygen uptake by the micro-organisms during that cycle time.

2.3.3 Automatic Respiration Rate Measuring Device.

Fujimoto, Iwahori, and Sato (1981), developed an automatic respiration rate measuring device. The principle of the measurement is based on the standard method for the sewage examination in Japan. Figure 2.11 shows the block diagram of the respiration rate analyzer. It is composed of a sensing device which is submerged in MLSS, and an electronic circuit which controls the sensing, and calculates the oxygen uptake rate. The sensing device is made up of a DO electrode, agitator, a measurement tank with temperature detector, and two valves, one for sample inlet and outlet and the other for air outlet.

The general operation of the device is as such: approximately one litre of sample is transferred by an air lift into the measurement tank, aeration is continued until the required DO level of 5 ppm is reached, the air within

5

The Figure has been removed because of the unavailability of copyright permission. Please refer to the original source.

Figure 2.11 Block diagram of the respiration rate analyzer. (Fujimoto, Iwahorio, and Suto 1981)

the tank is then extracted. The solution is continuously agitated and the DO concentration is detected through the DO electrode. The duration in which the DO concentration is decreased by 2 ppm is measured accurately to calculate the decreased DO concentration per unit time (OUR). This measuring process takes approximately 15 to 30 minutes.

This respiration rate analyzer has been tested under laboratory conditions and on an actual treatment plant. Satisfactory comparison has been reported between manual analysis value by the standard methods and the indicated values by the automatic respiration rate analyzer.

3. Design of the OUR Apparatus.

3.1 Objectives.

The objective of this study was to design an apparatus which automaticly measures the oxygen uptake rate (OUR) of micro-organisms in an activated sludge treatment process. The apparatus must be capable of automatically collecting a sample of activated sludge, aerating the sample for a given time to create an oxygen rich environment, measuring and recording the DO concentrations and temperatures of the sample while it is being agitated. Finally, it must release the sample and start the operation again.

The total automation of this apparatus is very much desirable to reduce the operation manpower, and costs of conventional OUR determination procedures. The total automation will also result in a consistent method of measurement. The DO concentration of the sample must be measured at a given time interval. The decrease in the sample's DO concentration with respect to time can then be calculated to obtain the OUR of the micro-organisms.

3.2 Physical Design

The basic physical design of the OUR Apparatus consists of a tank which holds a constant volume of sample, an agitater which can be controlled to mix the sample at all times, and a dissolved oxygen probe to detect the DO concentrations of the sample at any given time. After a volume of activated sludge is pumped into the apparatus measurement tank, the sample has to be aerated to create an oxygen rich environment for the micro-organisms utilization. The constant mixing of the sample ensures a uniformity of the sample volume; therefore the detected DO concentrations will be representative of the total sample volume. At the end of each test run, the sample has to be discharged and a new volume of sample is pumped or drawn into the measurement tank.

The main use of this apparatus would be at a sewage treatment facility. Therefore, it is important to design a unit which does not require any special needs, and is small, portable, and also durable in a harsh environment. Two preliminary designs of OUR apparatus were studied. One is the cylindrical type and the second is the cone type. Although both units are basically the same, after the preliminary evaluations the cone type unit was built for testing.

3.2.1 Cylindrical Type Design

The diagram of the cylindrical type is shown in Figure 3.1. This design consists of five solenoid valves, two of which are for sludge inlet and outlet, one for washing the tank after each test run, one for air to aerate the sample and one valve at the top used as an exhaust valve to let out air; a DO probe which is located approximately at mid-height of the cylinder, and a magnetic mixer which the cylinder

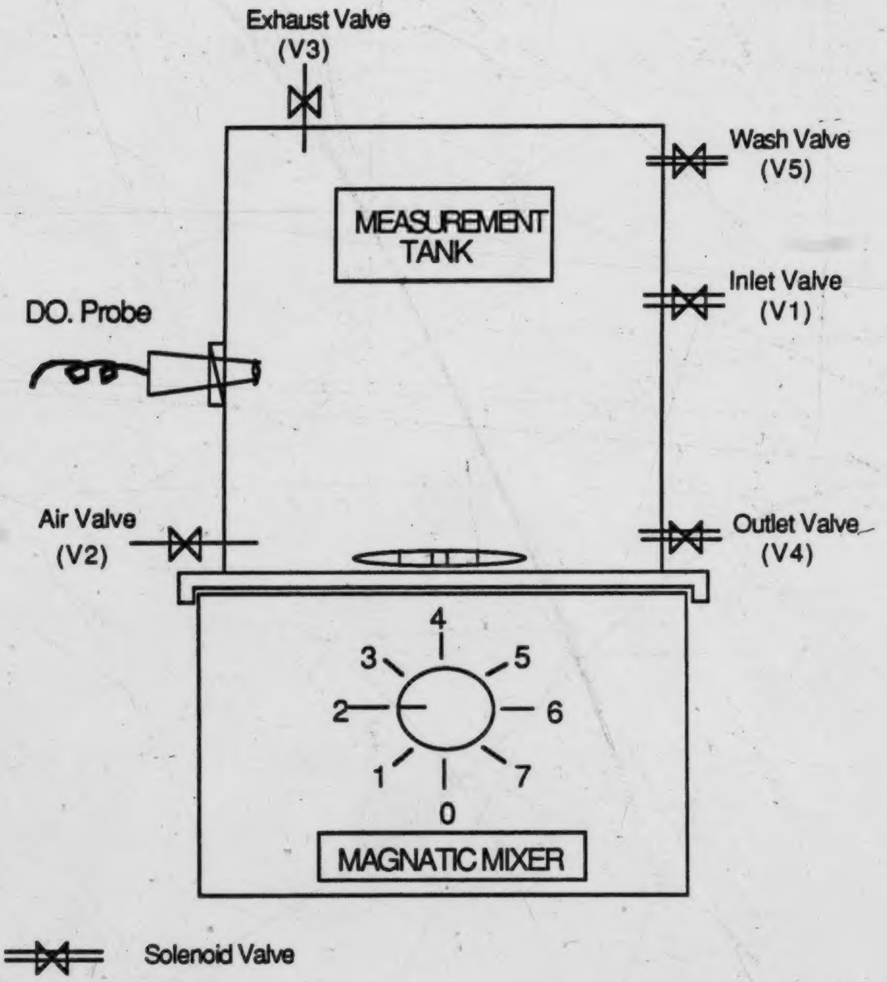

Exhaust Valve
(V3)
Wash Valve
(V5)
MEASUREMENT
TANK
Inlet Valve
(V1)
DO. Probe
Air Valve
(V2)
Outlet Valve
(V4)
4
3
5
2
6
1
7
0
MAGNATIC MIXER
Solenoid Valve

Figure 3.1 Cylindrical Design of The OUR Apparatus.

measurement tank sits on top of.

A sample of activated sludge is pumped into the cylindrical measurement tank through valve (V1). After a desired volume of sample (which is controlled by the pumping time) is pumped into the the cylinder, the air valve (V2) automatically opens and the sample is aerated. The sample is constantly mixed to help the oxygen distribution and uniformity of the sample. Valve (V3), which is an exhaust valve, will stay open during the aeration to prevent any pressure build up. After the sample is aerated the air valve and the exhaust valves are closed. The DO concentration of the sample is monitored by the DO probe and recorded with respect to time. At the end of a run the exhaust valve (V3) opens and the sample is discharged through valve (V4). The cylindrical tank is washed at the end of each run by opening the valve (V5) and pumping clean water into the tank.

The design of the cylindrical unit appeared to be suitable. However, two problems were foreseen with this design. One was the variation of sludge volume in the sampler. The volume of activated sludge sample in the tank is dependent upon the pumping duration and any change of the pumping rate would cause a change in the volume of sample used from one test run to another. The second problem that was foreseen was the final washing operation of the tank. It is important to start each test with a relatively clean tank since leftover micro-organisms could affect the next sample of activated sludge. However, problems might arise at locations where there are no accesses to clean water to wash the cylindrical tank. Therefore, a second design was considered in order to overcome these problems.

3.2.2 Cone Type Design.

The diagram of the cone shape design of the OUR apparatus is shown in Figure 3.2. To develop this design of the OUR apparatus two new objectives were considered. One was the self-cleaning feature of the apparatus; the second was some means of obtaining a constant volume of sample for each test run.

The self-cleaning characteristic of the apparatus can best be achieved by a cone shaped measurement tank. Therefore, at the end of each test run the outlet valve (V3) opens up and the sample volume will flow out under gravity. The outlet opening under the cone tank must be big enough to allow a free outflow of the activated sludge sample. Some suspended solids can settle during the testing operation and cause an obstruction with the outflow. In this case the aeration valve can be opened to break up any obstructions.

The consistency of the sample volume between each test run can prove to be important in relating and comparing the results from one run to another. To assure a constant volume of sample for each run, an overflow control system was designed for the apparatus. By pumping the sample volume past the overflow opening a constant height of the sample volume is ensured.

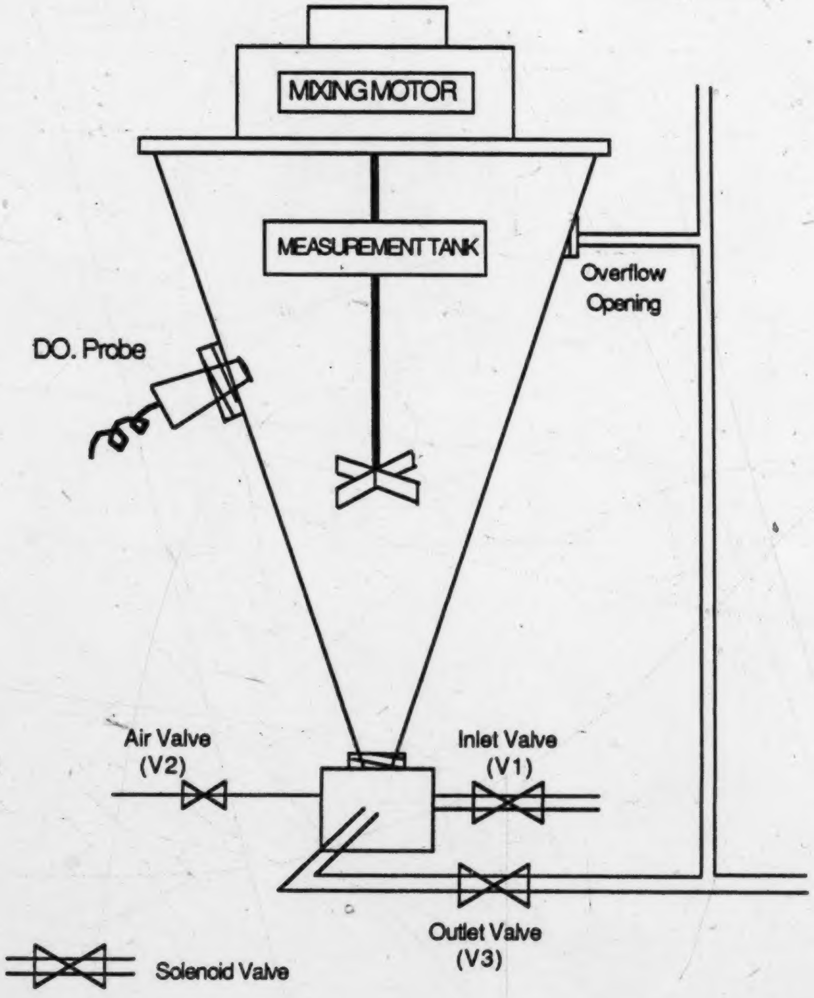

MIXING MOTOR
MEASUREMENT TANK
Overflow Opening
D.O. Probe
Air Valve (V2)
Inlet Valve (V1)
Outlet Valve (V3)
Solenoid Valve

Figure 3.2 Cone Shape Design of The OUR Apparatus.

The cone shaped OUR apparatus is made up of a 1000 ml settling cone which is used as a measurement tank, a mixing motor placed on top of the cone, three selenoid valves, two for the sample inlet and outlet and one for aeration of the sample, an overflow opening to insure a constant volume of sample for each test run, and a DO probe which is built on an angle for a better measurement of the DO concentrations. At the start of each run the inlet valve (V1) and the outlet valve (V3) are opened to flush out all the old sample which might be present in the lines. Then activated sludge is pumped or let in under gravity from the inlet valve (V1) into the measurement tank. The sample is then aerated for a specified period of time to generate an oxygen rich environment for the growth of micro-organisms. The sample aeration is achieved with a portable air compressor having a power of 460 Watts. Continuous mixing of the sample during the operation results in an even distribution of dissolved oxygen and uniformity of the sample. The DO concentration of the sample is detected by the DO probe at any given time. The drop in the DO concentration with respect to time represents the oxygen uptake rate of micro-organisms in the sample of activated sludge. At the end of each test run the sample is discharged through the outlet valve (V3) and the apparatus is ready for the next test run.

3.2.3 The Proposed Design of the Apparatus

From the preliminary studies of the two OUR devices, the cone shaped design was selected. The advantages of this design are the constancy of the sample volume used for each test run and its self-cleaning feature. This design was also found to be more flexible for future alterations which might arise from experimental runs. The size and the shape of the measurement tank can easily be changed. The depth, speed, and direction of the mixing propellers can be adjusted to optimize the mixing of the sample. A more uniform aeration of the sample volume can also be achieved with this design of the apparatus.

The possible problems which can be foreseen with this design are:

1. The size of the opening for the inflow and the outflow of the activated sludge sample. Depending on the characteristics of the activated sludge sample this opening might get plugged and stop the operation of the apparatus.
2. The size and shape of the measurement tank. The size of the tank might have to be increased to give a better representation of the original volume of mixed liquid. Also, the shape of the tank might have to be changed to achieve a better mixing of the sample.
3. The self-cleaning feature of the apparatus. The ratification of this feature, as to whether an acceptable cleaning of the apparatus is achieved or not,

will be determined through experimental runs.

4. Variation of the sample temperature. The sample temperature changes after it is taken out of the volume of the mixed liquor. The duration of each test run is short and the sample temperature is not expected to change enough to affect the micro-organisms activity and the oxygen utilization rate. In the case of large temperature variations the sampler tank can be insulated to keep the temperatures constant throughout the operation.

The signifigance of these foreseen and other unforeseen problems were investigated through a series of test runs.

3.3 Automation of the OUR Apparatus.

One of the major objectives in the design of the OUR apparatus was its automation. A sample volume must automatically be drawn into the measurement tank, aerated until an oxygen rich environment is obtained, monitor the DO concentration and temperature variation, then discharged. At the completion of each test run the apparatus must record the collected data then procede to the next test run. To acquire this type of automation, computer and electronic systems were interfaced to the mechanical structure of the apparatus, and a software program was written to carry out the operation of the OUR apparatus.

The micro-computer was programmed beforehand to systematically collect the sample, monitor and record the DO and the temperature values of the sample at a given time interval, then release the sample. The inlet, outlet, and the aeration valves of the OUR apparatus, are all of solenoid type which can be opened and closed at any time with a signal through the micro-computer by the software. The mixing motor and the inflow pump are also controlled by the computer program. The DO concentration and the temperature values of the sample are detected with a dissolved oxygen probe which is installed in the apparatus. The detected values are then signalled back to the computer to be stored on magnetic disk.

3.3.1 Computer and Electronic Link

The total automation of the OUR apparatus is achieved through the link of the computer and electronic systems with the mechanical structure of the apparatus. The micro-computer system applied to control the operation of the apparatus is operated through software programs, and operator's instructions. This micro-computer system is capable of storing the collected information on a data registry system, either a floppy disk or a tape. The stored information can then be saved for the production of a hard copy. These technical requirements of the controlling micro-computer system are available by most of the micro-computer systems on the market; however,the main objective which led us to the system selected was the cost of the system. One of the older models of the Commodore micro-computers was used in this study. It will be described in detail in later sections. In future developments of the automatic OUR apparatus, the Commodore 64 or IBM PC micro-computers are recommended. These system are more advanced than the one used and are still available at a reasonable price. Also, the software programs developed in this study can be easily modified to operate with these micro-computers.

The electronic systems which were required in the automation of the OUR apparatus are an AC solid state switching device and an Input/Output system in conjunction with a DO and temperature measurement meter. The AC solid state switching device is used to control the operation of the 120 volts AC devices on the OUR structure, such as the opening and closing of the solenoid valves. The Input/Output system in conjunction with a DO meter is used to collect DO and temperature measurements, and to relay these values to the micro-computer system. These two electrical units can be put together in one box to form a single electrical system which is greatly recommended for the future designs. However, in this preliminary design and study of the OUR apparatus these units were developed separately and are referred to separately. The AC solid state system is referred to as the Dissloved Oxygen Chamber Control (DOCC) unit, and the Input/Output system plus the DO meter is referred to as the Dissolved Oxygen and Temperature Monitoring (DOTM) unit.

3.4 Computer and Electronic Systems Used.

The computer control and the electronic systems used in the development of the automatic OUR apparatus can be broken down to three units. The main computer unit which controls the two electrical units, is the Commodore 2001 series (PET) micro computer. The second unit is the DO and temperature measurement device which is connected to a dissolved oxygen probe to detect the DO and temperature of the collected sample. The third unit is the Dissolved Oxygen Chamber control device which is responsible for sample collection, aeration, mixing, and discharging of the sample. The relationship of these three units with each other and with the apparatus is illustrated in Figure 3.3. The Motor Speed control unit shown in this figure is a temporary unit which controls the speed of the mixing motor on the apparatus. In future designs this unit can be included with the other two units or it can be totally eliminated if through out the experiments we find that the variation of the sample's mixing speed dose not affect it's OUR measurements. For detail operation manual and the instructions of the Automated Oxygen Uptake Rate Measurment system refer to Appendix F.

The Commodore 2001 series (PET) computer is programmed, using a Basic language program, to operate the Dissolved Oxygen Chamber Control device and the DO and Temperature Measurement device. Signals are sent out from the PET to these units to carry out their task. The Dissolved Oxygen

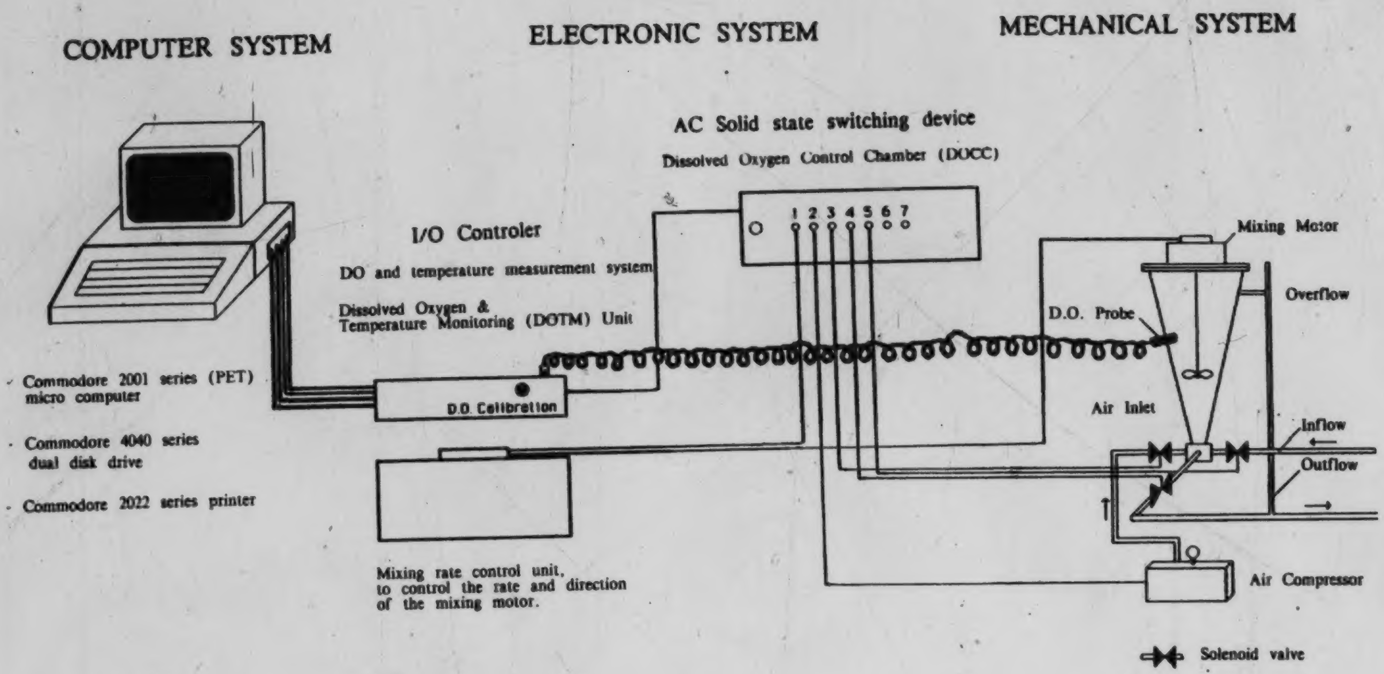

COMPUTER SYSTEM
ELECTRONIC SYSTEM
MECHANICAL SYSTEM
AC Solid state switching device
Dissolved Oxygen Control Chamber (DOCC)
1 2 3 4 5 6 7
I/O Controler
DO and temperature measurement system
Dissolved Oxygen & Temperature Monitoring (DOTM) Unit
D.O. Calibration
Commodore 2001 series (PET) micro computer
Commodore 4040 series dual disk drive
Commodore 2022 series printer
Mixing rate control unit, to control the rate and direction of the mixing motor.
Mixing Motor
Overflow
D.O. Probe
Air Inlet
Inflow
Outflow
Air Compressor
Solenoid valve

Figure 3.3 Schematic Diagram of The Systems and Their Relation With Each Other.

Chamber Control unit handles the opening and closing of the solenoid valves on the OUR apparatus, the turning on and off the pumping and mixing motors, and operating the compressor for the aeration of the sample. The DO and Temperature Measurement unit, in response to PET's message, detects the DO concentration or the temperature of the sample. The measured values are transmitted back to the main computer to be stored in its memory bank. The stored values are finally dumped into a floppy disk for storage and print out.

3.4.1 Micro-computer System.

The micro-computer system associated with the OUR apparatus is a Commodore 2001 series (PET). This system consists of a screen and keyboard with a 32k memory, a Commodore model 4040 dual disk drive, and a Commodore 2022 series printer. The Commodore series 2001 (PET) computer was modified by the University of Alberta, Department of Civil Engineering Electronics Group to interact with the Dissloved Oxygen Chamber Control device and the DO and Temperature monitoring device.

To program the PET computer to operate the OUR apparatus a software program called the "OUR.OPERATION" was developed. This program is loaded to the computer memory from a floppy disk. By running this interactive program and feeding all the required information, the computer will be able to operate the OUR apparatus.

The PET computer sends out messages to activate the Dissolved Oxygen Chamber Control and the DO and Temperature monitoring units. There is a one way communication line between the computer and the Dissolved Oxygen Chamber Control device. Messages are only sent from the computer to the device and there are no messages returned from the device. However, the DO and Temperature monitoring device and the PET computer are on a two way communication line. PET computer sends out messages to the device to collect a DO or temperature reading. This collected data are then sent back to the PET computer to be displayed on the screen and then stored on a floppy disk.

3.4.2 The Dissolved Oxygen Chamber Control Unit.

The Dissolved Oxygen Chamber Control (DOCC) unit is an electrical control system designed by the University of Alberta, Department of Civil Engineering Electronics Group to operate the solenoid valves, mixing motor, and other electronic devices on the OUR apparatus. This unit has a capacity of controlling up to seven independent 120 volts AC devices and it is attached to the OUR apparatus structure. Computer signals are first sent to the DO and Temperature monitoring unit, then the appropriate commands are signalled to the DOCC unit to operate the AC devices.

Five circuits of the DOCC unit are currently being used to operate the OUR apparatus. The extra circuits are available for future control options. Each of the three solenoid valves, the mixing motor, and the inlet pump, is connected to a separate circuit. The switching on or off of the circuits are carried out by the signals from the PET computer. At the start of the operation all the circuits are initialized to be closed. In the case of the solenoid valves, if a circuit is switched on, the valve is open and if the circuit is switched off, the valve is shut closed.

With the present design of the DOCC unit the mixing rate and the inlet pumping rate can not be controlled. In the future these control options can be added easily to the system. Presently, the mixing rate of the motor is controlled by two other units, one a 5 channel Motor Speed Servo Controller system which is used to adjust the mixing rate, and a second device which switches the direction of the propeller's rotation from clockwise to counter clockwise. These devices can be adjusted to optimize the mixing of the activated sludge sample.

3.4.3 The Dissolved Oxygen and Temperature Monitoring Unit

The Dissolved Oxygen and Temperature Monitoring (DOTM) unit has been put together by the University of Alberta, Department of Civil Engineering Electronics Group, using a similar design as a commonly used portable Yellow Springs Instrument (YSI) DO meter. This system was interfaced with the PET computer.

Like any ordinary DO meter, this unit has been designed to be calibrated for DO readings. The operator has a choice of three calibration methods, Winkler Titration, Saturated water, and air. The three methods are described in the Instruction Manual for the Dissolved Oxygen Meter. To calibrate the DOTM unit according to these methods the detected DO values are flashed on the screen of the PET computer with the aid of the software program. These readings are then adjusted to a determined calibrated value by turning the knob on the DOTM unit, thus calibrating the device.

The DOTM unit is on a two way communication system with the PET computer. Signals are sent by the computer to the unit to detect the DO or temperature of the activated sludge sample through an ordinary DO probe which is inserted in the sample. This collected information is then signalled from the DOTM unit to the computer to be stored.

3.4.3.1 Adjustment of The DOTM Unit.

The DOTM unit had to be adjusted to insure an accurate reporting of the DO and temperature values. The compatabililty of the DOTM unit with a Yellow Springs Instrument (YSI) DO meter was examined through many preliminary test runs in which the results of these two units were compared with one another. In the final set of tests the DO readings of the DOTM unit were compared to two portable DO meters and a randomly used Winkler titration test method for determining DO concentrations. These experimental tests were run until satisfactory results were obtained (some of the test results are shown in the Appendix A.)

To adjust the DOTM unit's temperature readings, the readings of this unit were tested against an ordinary thermometer. However, due to a non-linear relationship between the measured resistance of the DO probe and the true temperatures measured by the thermometer these readings did not compare well. This non-linear relationship is taken care of in the YSI DO meter by using a non-linear scale on the temperature read-out of the meter. We were not able to compensate for this non-linearity in the software program, therefore, it was decided to approximate a linear relationship for the true temperature and resistance values within the operating temperature range of the samples and program the software accordingly. Consequently, we are only able to approximate the temperature values of the sample, and sometimes the true temperatures and the reported temperatures can vary up to 2.5 to 3.0 degrees Celsius. To reduce the discrepancy of the temperature readings the system was calibrated for the expected range of temperature readings of the mixed liquor samples collected from a wastewater treatment plant.

3.4.3.2 Problems With The DOTM Unit.

The design of the DOTM unit was adapted after an ordinary portable DO meter. A number of problems were revealed during the alteration of this design to accommodate a new set of requirements. These problems were:

1. For the design of the DOTM unit the zero reading indicator and the red line indicator of the YSI portable DO meter were bypassed. These alterations caused an error in the operation of the unit. Thus, it was concluded that no changes can be made to the design of the DO meter circuit. Therefore, on the DOTM unit as far as the DO and the temperature readings are concerned the design is kept the same as the YSI portable DO meter. The required additions which will allow the interface of the unit to the micro-computer were separately added to the end of the DO and temperature measurement circuit.
2. Some parts of the portable DO meter circuit are unique to the system which caused some problems in the design of the DOTM unit. For example, the DO probe on the DO meter has a resistor which relates to the temperature readings. The curve relating this resistor to the temperature readings was not found in any electronic hand book. Therefore, an approximated curve for the resistor had to be manually determined, in order to calculate the temperature values. This curve turned out to be non-linear and caused many problems in the adjustment of the unit to measure the temperature values.

3. The unit was found to be sensitive to frequent switching between DO and Temperature readings. The reason being, that in the case of frequent switching the signals from one channel were produced on top the signals from the second channel; i.e. during the alteration from DO reading to temperature reading, the signals from the DO channel were not settled down (gone to zero) before the signals for the temperature readings were passed through. To over come this problem a short time delay was created in the software program to allow enough time for one signal to go to zero, before a second signal is read.

3.4.3.3 Recommendations.

It is recommended that for the future design of the DOTM unit a separate probe should be used for temperature and DO readings. There are many different electronic temperature measurement systems available that can be adopted to the DOTM unit. However, the system which is chosen should have a linear resistance versus temperature relationship; hence, this linear relationship can be programmed in the software to result in a more accurate calculation of the temperature readings.

The DO measurements circuit and the temperature measurements circuit should also be separated. This will reduce the background noise on the circuits, therefore, no overlapping of the signals can occur to cause any error in the readings.

4. Software Developed

Two different types of computer software programs were developed to carry out the required tasks of the automatic Oxygen Uptake Rate measurement apparatus. One was the "OUR.OPERATION" program which operates the OUR apparatus to collect samples and continuously measures the available dissolved oxygen and the temperature of the sample. This program controls the sampling time and the intervals at which the data are collected. The collected data are then stored by the program on a floppy disk. The second type of program developed is the Printout program, which is used to obtain a hard copy of the collected data and a plot of the data points with respect to time. There are three versions of the printout programs developed, two of which are designed to produce a hard copy on the Commodore printer, and one which produced a hard copy through the University of Alberta's computing system.

The OUR operation and the Printout programs are written in BASIC programming language for the PET computer and in FORTRAN language for the University of Alberta's computing system. The BASIC language is popular with commercial micro-computer systems; by using this language the interchange from one computer to another computer is possible. The detail flowchart, and the listing of the programs are shown in Appendix B.

4.1 OUR Operation Program.

The OUR Operation Program interactively collects the necessary information to operate the OUR apparatus; then the program, according to the given instructions, obtains and stores the DO and temperature measurements of the sample. The OUR Operation Program is designed to be simple to operate and flexible to any changes which may be necessary in the future. This program has been continuously revised and improved in order to achieve a more efficient operation technique, and a better method of data collection, data storage, and data presentation. The operation of the OUR operating program can be broken down into four stages; first is the program initialization stage, second is the instruction and information collection stage, third stage is the actual mechanical operation of the apparatus, and the fourth stage is the decision-making stage of the program where the decision is made whether to continue or to stop. The general flowchart of the program given in Figure 4.1 illustrates the relations of these stages with one another. The detail flowchart and listing of the program is given in Appendix B.

The OUR.OPERATION program can be instructed to run continuously to collect and analyze a number of samples. For each testing cycle the program creates one data file to store the collected data. Each floppy disk is capable of registering up to 144 data files; therefore, with a dual disk drive the program can store up to 288 test runs without

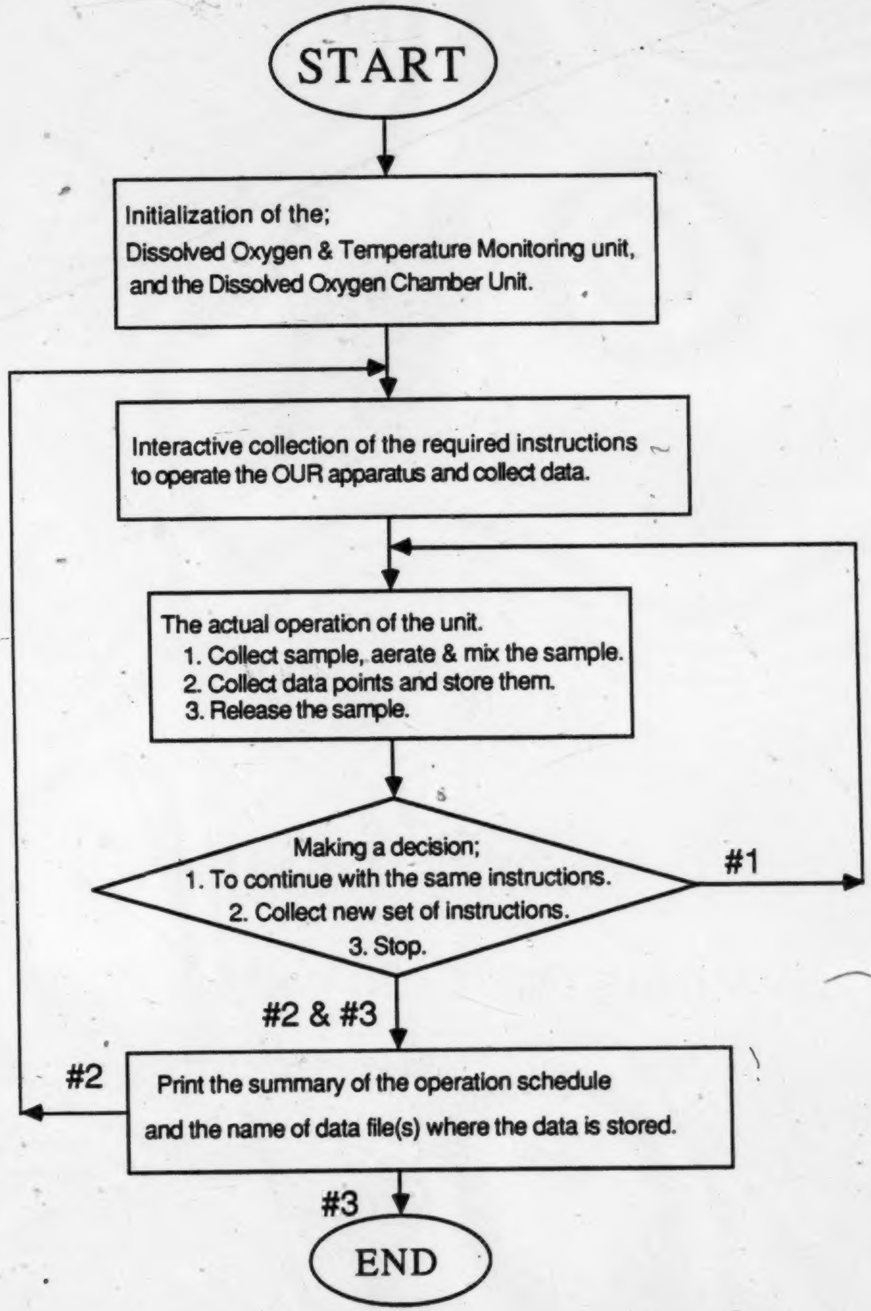

START
Initialization of the;
Dissolved Oxygen & Temperature Monitoring unit,
and the Dissolved Oxygen Chamber Unit.
Interactive collection of the required instructions
to operate the OUR apparatus and collect data.
The actual operation of the unit.
1. Collect sample, aerate & mix the sample.
2. Collect data points and store them.
3. Release the sample.
Making a decision;
1. To continue with the same instructions.
2. Collect new set of instructions.
3. Stop.
#1
#2 & #3
#2
Print the summary of the operation schedule
and the name of data file(s) where the data is stored.
#3
END

Figure 4.1 General flowchart of the OUR operation program.

any supervision. To increase this data storage capacity, a full data disk can easily be replaced with an empty disk during the operation of the program; thus, an unlimited number of test runs are possible without stopping the program.

4.1.1 Initialization Stage of The OUR Operation Program.

At the beginning of the OUR operation program the DOTM and the DOCC electronic units are initialized. The initialization of these units sets up the communication lines between them and the computer. The initialization is done by initiating the Versatile Interface Adaptor (VIA) computer chip NO. R6522, of the DOTM unit. The 8-bit bi-directional I/O of this chip are half-initialized to act as input communication lines and half as output communication lines.

To insure a successful initialization of this chip, first the DOTM unit and then the DOCC unit has to be switched on before the OUR operation program is run. After the chip has been initialized signals are sent by the program to the DOCC unit to shut off all the circuits on the apparatus. At this point all the communication lines between the electrical units and the computer are identified. Many computer memory locations are also assigned, at this stage of the program, to receive and store data points from the DOTM unit.

4.1.2 Instructions and Information Collection Stage.

After the initialization of the DOTM and the DOCC units, the OUR operating program looks for an input of the operation instructions. This section of the Program is self-explanatory in the order and method it expects the required information. There are two modes of obtaining instructions by the program; one is the detail questionnaire which is suitable for the beginner, allowing him to understand fully the questions and the system's operation, and the second mode is a short questionnaire which is designed to speed up the data input process. The full listing of both the detail questionnaire and the short questionnaire are shown in Appendix D.

The information collected by the program is not all directly used in the operation of the apparatus. Much of this information is used to guide the program during the operation of the apparatus and some is stored with the collected data points for future reference and identification of the files.

4.1.3 Mechanical Operation of The Apparatus.

This portion of the OUR program is responsible for operating the apparatus and collecting the data points. All the operational commands of the apparatus, such as opening and closing of the valves, are time-dependent. The operation of these commands will be signalled according to pre-set intervals of time. The reference time for each of the intervals is the initiation of the operation. There is an internal clock within the computer which is set to zero at the beginning of each sampling cycle. This internal clock is continuously checked against the starting time of the commands and as soon as the time is reached the command will be signaled to be carried out.

At the beginning of each sampling process both the inlet and the outlet solenoid valves on the apparatus are signalled to be opened. This will allow for the flushing of the old samples which exist in the apparatus sample lines for approximately 15 seconds. Then the outlet valve on the apparatus is closed and the sample starts to fill the measurement tank. At the same time, the mixing motor, the air compressor, and the air valve are signalled to start mixing and aerating the sample. The sample inlet line closes after the measurement tank is full. The aeration of the sample continues as long as it has been instructed by the operator, usually 3 to 5 minutes. The sample is mixed for the total duration of the test run.

The collection of the DO and the temperature readings will start after the measurement tank is full and the inlet valve is closed. The frequency of these readings is dependent on the instructions given by the operator at the beginning of the OUR operation program. The time at which each DO and temperature measurement is taken, and the measured values are listed on the computer screen for an instantaneous show of the values. These data values are then stored in the computer memory and eventually saved under a selected file name on a floppy disk. In the case of a series of test runs only one file name is needed by the program. The program will automatically add to the end of the original file name the test run number; hence, each test run can be distinguished with an original file name plus its numerical suffix.

To identify the time of the day at which a sample was collected and analyzed, the program has a sub-routine which keeps track of the time on a 24 hour clock; this sub-routine also controls the daily, monthly, and annual increments. The sub-routine, has to be set at the start of the program; then it will automatically register the incremental changes. The time and the date at which a sample is tested are stored by the program with each data file to identify the file.

At the end of each test run the outlet valve on the apparatus will be opened and the sample is washed out by gravity. The program is then continued into the decision making stage to evaluate whether to continue with the same information, or whether to obtain a new set of information, or whether to stop.

4.1.3.1 Communication Between the Computer and the Electronic Devices

The operational commands are signalled by the computer to the DOCC unit through a BASIC command called POKE. A computer memory location is poked with a pre-set binary numbers to carry out an operation. Memory location 36864 on the PET computer is a message route to the DOCC unit. The single operation of the binary numbers which can be poked at this location are:

1- To open the inlet valve.
2- To open the air valve.
4- To start the air compressor.
8- To start the mixing motor.
16- To open the outlet valve.
64- To start the inlet pump.
128- Extra circuit.

By entering the command POKE 36864,1 the inlet valve will open. A combination of these binary numbers can also be used to carry out a series of commands. For example, by POKING the number 14 which is the sum of 2+4+8 , the air valve, the air compressor, and the mixing motor are all signalled to turn on at once.

The communication lines between the computer and the DOTM unit is a little more complicated. Memory location 36876 on the PET computer is the communication line to the DOTM unit, to read either the DO or the temperature measurements. By poking the number 205 to this location temperature measurements are collected, and number 237 will start the DO readings. The measured values can be signalled to the computer through the memory location 36865. To receive data from the DOTM unit a combination of BASIC commands, POKE and PEEK statments are used. The measured data points are transferred one digit at a time, and the commands for each digital reading is:

```
POKE36865,00 : D0=(PEEK(36865)AND15) . . First digit.
POKE36865,32 : D1=(PEEK(36865)AND15) . . Second digit.
POKE36865,64 : D2=(PEEK(36865)AND15) . . Third digit.
POKE36865,96 : D3=(PEEK(36865)AND15) . . Forth digit.
```

For each DO and Temperature reading three sequental measurements are obtained by the program and averaged; the average values are then stored. This averaging process is designed to reduce the error in the measurements. Electrical instruments are quite sensitive to small variations and can be disturbed easily. Therefore, by obtaining three consecutive readings, and averaging them, the error which can be caused by a single disturbance is reduced. The three readings which are averaged are taken less than one second apart; therefore, there should be no measurable change of the values between the readings.

4.1.4 Decision-making Stage

After the operational stage of the program is over and the required data sets have been collected and stored, the program continues to the Decision-making stage. At this stage the program, according to the initial input instructions, decides whether to continue with the same instructions, to obtain a new set of instructions and continue, or to stop.

If the program is instructed to continue for a given number of tests, a counter sub-routine is checked to determine whether the total number of runs have been reached or not. If this number is not reached the program is directed to the start of the operational program. If the total number of test runs has been reached the computer is instructed to stop.

Before the program is stopped it will list on the screen the summary of all the operations it has done and it will give the name(s) of the data files under which the collected data are stored. This summary is also given if the program is instructed to collect a new set of instructions for its next run.

4.2 Data Printout Programs by the Micro-computer

The data printout programs by the micro-computer are specially designed to read and print a set of data stored by the OUR.OPERATION program. The means of accessing a data file and the format used by the data printout programs to read a set of data are comparable to the method in which the OUR.OPERATION program has stored the data points. This uniformity between the programs will allow access to the stored data files and an accurate readout of the data values. The data files collected by the OUR.OPERATION program consists of three sections. First is the file identification section where all the information regarding the test run are stored. The second section contains all the collected DO concentration data points and the third section contains the recorded temperature measurements. To identify the end of each file section in the data file, a dummy variable is used. This method of sections identification gives the readout program the flexibility of reading a different number of data points for each data section. A copy of the raw data file is shown in Appendix C.

Two versions of the printout programs by the micro-computer have been developed. One is a detailed printout program (BA.PRINTOUT); this program reads and prints out all the collected data and information for each test run; it also plots two graphs, one being the measured DO concentrations of the sample vs. time, and second the measured temperature of the sample vs. time. The oxygen uptake rate value (OUR) of each test run is also calculated and printed by this program. The second version of the printout program by the micro-computer is a summary printout program (BA.SUMMARY). This program reads all the collected DO concentrations for each test run and calculates the OUR value of the samples accordingly. These calculated OUR values are finally listed and plotted against the time of day at which the samples were collected. A more detailed description of the data printout programs is as follows.

4.2.1 The BA.PRINTOUT Program

The BA.PRINTOUT program is the detailed printout program through which all the collected data points of an individual test run are listed. The plots of the DO concentrations vs. time and the temperature vs. time are also constructed by this program. The plots created by this program illustrate in detail the variation of the dissolved oxygen and the temperature values of the sample during the test run. The program will also calculate and print the Oxygen Uptake Rate of the micro-organisms for each sample. The flowchart and the listing of this program are presented in Appendix B.

The required instructions for the BA.PRINTOUT program to find the data files and to operate has to be interactively input into the program. There is an option within the program which gives the operator the choice of printing only one data file, or a number of selected files, or a series of data files from a continuous test run. In the case where the program is instructed to read a series of data files only the original name of the file and the number of test runs which have been stored under this name must be given to the program. The BA.PRINTOUT program, in the same manner as the OUR.OPERATION program, will automatically add to the end of the original file name the test run number and will search for the data file on the floppy disk.

A copy of the printout produced by the BA.PRINTOUT program is given in Appendix C. This printout refers to the sample collected on April 19, 1985 at 14:04 P.M. The BA.PRINTOUT program plots consist of three sections. The first is the listing of information which give the details of the test run, such as the time and date at which the sample was collected and analyzed. Also listed in this section are the testing procedures including the total test time, the total aeration time, and the frequency of the DO and the temperature readings. The second section of the printout consists of the listing of time in seconds and in minutes after the start of the test run at which the DO readings were taken, the measured DO values, and a plot of the DO values vs. time. The OUR value of the sample is calculated and printed at the end of this section. The third section of the printout is the listing of the recorded sample temperatures made during the test run and also a plot of the temperature vs. time.

According to the initial information and DO vs. time plot shown in Appendix C section C1, the sample was aerated for the first 4.1 minutes, shown by the initial increasing DO concentrations. After aeration of the sample the available DO concentrations are gradually decreased as a result of the micro-organisms utilization. The dissolved oxygen exhaustion is reached about 25 minutes after the start of the operation. The slope of the available DO vs time plot represents the OUR value of the sample and it is calculated using the Least-Squares method. The number of data points which are used by this method to calculate the

OUR value depends on the rate at which the available dissolved oxygen is decreased. Any DO concentrations collected after the aeration stage, down to the DO concentrations of 1.0 mg/L, are included in this analysis.

This gradual decrease of the DO concentrations as a result of micro-organisms oxygen utilization, is very similar to the results obtained through manual tests. The slope of the available DO vs. time graph varies depending on the number of micro-organisms present, the degree of their activity, the availability of substrates, and many other parameters which have been discussed in the second chapter.

4.2.2 The BA.SUMMARY Program.

The purpose in developing this program was to calculate the OUR value of a number of sample test runs from their collected data points, and plot these calculated OUR values (mg/L.hr) with respect to the time at which the samples were collected. The plot constructed by this program will illustrate the variation of the mixed liquor's OUR value during the operation of the apparatus. The flowchart and the listing of this program is shown in Appendix B.

The means of the program accessing a data file and obtaining the data points from a single test run is basically the same as the BA.PRINTOUT program; however, the data points are not printed or plotted for each test run. Instead, the OUR values of the samples are calculated by the program using the least squares method, and the temperature measurements of the samples are averaged throughout the test run and stored in the computer memory. All the calculated OUR values and the averaged temperature measurements and their corresponding sampling times are then listed and plotted by the program.

A copy of the BA.SUMMARY program printout is given in Appendix C. This printout is made up of two parts. First is the information section which identifies the date, and the time at which the operation started and the names of the data files under which the data are stored. In the second section a listing of the sampling time and the corresponding OUR and the average temperature values of the sample are given. A plot of the OUR and the average temperature values with respect to the sample collection time is also constructed in this section, for a quick visual study of the OUR and Temperature variations during the test period. The vertical lines intersecting the plot identifies the mid-night of the testing period.

4.3 Transfer of Data to University of Alberta Computing System

More powerful and extensive methods of data analysis and presentation are available on the University of Alberta's computing system. Transferring the data points collected to this system will allow for further analysis. With the University of Alberta computing system (MTS), an enormous number of data points can be stored and analyzed at a much greater speed than on the Commodore micro-computers. Therefore, in general, it is more advantageous to use a large system in data processing and analyzing.

In the following sections a description of the hardware and software programs which were used to transfer the data files to the MTS are given. Two software programs were developed in this stage of the study; one to condense a series of data files into one large file to be transferred, and a second software program, developed on MTS using the Fortran language, to analyze and plot the transferred data points.

4.3.1 Transferring Technique

To transfer data files from a floppy disk to the Univerity of Alberta computing system (MTS), a unit called a MODEM and a software program known as the XMODEM was used. This unit and the software program are compatible to the Commodore 64 micro-computers. Therefore, a Commodore 64 micro-computer was used to transfer the files.

The MODEM, attaches to the Commodore 64 keyboard. This unit is then connected to a telephone line which is the communication line between the Commodore 64 micro-computer and MTS. Through a software program (Master Modem) which is loaded in to the micro-computer, the phone number to the University of Alberta computing system is dialed, thus connecting the two systems together. After a successful connection of the two systems, the Commodore 64 will act as a terminal on the U. of A. system.

The XMODEM software program is a program which will allow for the error-free transfer of the files. This software program must be available both on the microcomputer and MTS. The XMODEM software is loaded on to the Commodore 64 micro-computer by loading the Master Modem program which also operates the modem connected to the keyboard. On the University of Alberta's computing system (MTS), the XMODEM program is available in a library file, and is activated by the "$RUN PCS:XMODEMFT" command.

4.3.2 Software Program to Condense the Data Files for Transfer

As mentioned earlier, the OUR operation program stores the data points for each test run under a different file name. It would be impractical to transfer each one of these small files independently to the MTS. Therefore, a software program called a "DTD.CONDENSER" was developed in the BASIC language to condense a series of data files into one large data file to be transferred to the MTS. A flowchart and a listing of this program is given in Appendix B. During the operation of the DTD.CONDENSER program, the program opens one data file at a time from the data disk. It then copies that file onto the second disk which has a file open at all times. Therefore, it is important that during the operation of the program the disk drives are not disturbed at all. When a series of data files are stored on more than one floppy disk, the program is designed to read as many data files as it can from one disk, then it will automatically ask for the second disk to continue with the operation of the program.

The information required by the program to locate a series of data files are inserted in the program interactively. For this program to operate, the micro-computers must be equipped with a dual disk drive. The program reads the data values from the individual data files through the first disk drive and then it copies them directly to the condensed file on the second disk drive. This program has been designed to not only copy the data points from a series of files into one file but also, to condense the data file by eliminating any extra spaces between the data point and ignoring any repetitious information which may exist in the data file. The program eliminats any dissolved oxygen data points lower than 0.5 mg/L which will not be used in the least squares analysis of the OUR calculation.

In developing the DTD.CONDENSER program, special attention had to be given in proper reading of the data points and in copying their condensed version onto the new data file. The format of the new condensed file had to be acceptable to the Fortran programs which was used on MTS to analyze the data points. In addition, to properly copy each data point from one disk to another, the condensed data files had to be properly labled by the program for future identificatin of the file.

4.3.3 Software Programs Developed on the University of Alberta Computing System

There is one program that has been developed on the University of Alberta computing system (MTS) to analyze the raw data transferred to this system. This program is known as the OUR.PLOT program, written in Fortran language. The listing of this program is given in Appendix B. The main objective in developing the OUR.PLOT program was to produce an accurate plot of the OUR values and to generate a formatted listing of the collected data points to help in analyzing and documenting the experimental test runs. With the aid of this program a plot of the OUR values with respect to their collection time and a tabulated listing of the data values are made available in a matter of hours. The overall analysis and comparison of the experiment are made easier with this type of documentation.

The OUR.PLOT program consists of four parts. First is the data readout section in which data points are read from a data file according to the format that they were stored in the file. The second part is the data analysis section, in which the OUR values of each test run is calculated by the program using the least squares method of slope analysis. To calculate the OUR values by the Least Squares method, the program is designed to eliminate any data points with a dissolved oxygen value of less than 1.0 mg/L. From experimental runs it was noted that the rate of oxygen utilization at lower concentrations of available dissolved oxygen did not correspond with the general rate of oxygen utilization of the sample through out the test run. The third section of the OUR.PLOT prgoram is designed to arrange the data points in a tabular format and copy them onto an output file. The fourth and final section of the program calls for a PLOTIT program to construct a plot of the OUR and the average temperature values of the sample versus their collection time. A copy of the table of data points and the plot constructed by this program is shown in Appendix C.

4.4 Recommendation and Improvements of the Software Programs

To improve the practicality of the OUR apparatus and to use it as a control parameter in an activated sludge wastewater treatment plant some alterations and expansions of the software programs are suggested. The suggested improvements are of two kinds; one is the alteration of the existing program to improve the data collection and presentation techniques; the second is, write new programs to improve the data handling and analyzing methods. These improvements can be made as the need for them arises.

The OUR.OPERATION program which operates the apparatus and the printout programs which produce a hardcopy of the data points are the first versions of their type. Although these programs were altered and expanded throught out the course of this study to improve the apparatus operation, data collection, and presentation of the data; however, the main objectives of these programs were to be used as a preliminary study of the OUR apparatus and its capabilities. Now that some of the capabilities of such apparatus are understood, new software programs can be developed to best suit the requirements of an on-line automatic monitoring system. With the existing program, 72 hours of half-hour sampling data are collected on one floppy disk and a hard copy of the data is obtained after 3 days for studying. This delay between the data collection and analysis defeat the main purpose of the proposed automatic OUR measurement apparatus, which is to be used as an on-line controlling parameter in an activated sludge wastewater treatment plant.

The OUR apparatus can be used to detect any unusual changes of the oxygen uptake rate of the mixed liquor in an activated sludge wastewater treatment plant. The cause of these irregularities can then be looked into immediately to minimize their effect on the treatment process. In such a case, a quick visual representation of the calculated OUR values and a warning to the operator is important. The suggested recommendations to meet these objectives are:

1. Combining the OUR program and the BA.PRINTOUT program. This will result in a simultaneous printout of the data values as they are being collected. Therefore, any unusual reading can be detected immediately.

2. Expanding the OUR program to plot the calculated OUR values vs. time of day on the computer screen. This plot which has to be updated after each test run will allow for a visual detection of any unusual OUR values.
3. Through many experimental runs, a band of acceptable OUR values can be determined in which the normal fluctuation of the OUR values takes place. Hence, the software can be programmed to detect any violations of these acceptable limits, and activate an alarm to warn the operator of this violation.
4. The data collection technique has to be studied further to condense the number of data points stored or collected. Only the important data points should be stored for hard copy and future reference.
5. Use of the statistical packages available on the University of Alberta's computing system to analyze the collected data and formulate a relation of the OUR values and the effuent quality of the plant. This will give the operator an excellent monitoring tool of the treatment plant.

5. Evaluation of the OUR Apparatus.

The collective operation of the hardware and the software systems was the next stage of development of the Automatic Oxygen Uptake Rate measurement system. These two systems were found to work well independently, however, after their initial collective operation a few design changes had to be made to improve the operation of the system. A control air valve had to be installed after the air inlet solenoid valve to control the amount of air entering the cone measurement tank. Also, time delay DO-loops had to be inserted into the software program to allow for the drainage of the old samples in the lines at the start and at the completion of the test run..

The apparatus was first tested with activated sludge sample which was obtained from the Gold Bar treatment plant, in a laboratory environment. A series of tests were conducted with this sample to observe any flaws with the design or operation of the apparatus. It was found that the activated sludge sample was well aerated and mixed during the operation of the apparatus and the inflow and the outflow lines were never plugged, therefore, no additional alterations were necessary.

The system's operation and precision of the apparatus has been evaluated through three different testing programs. First testing schedule was set up to show the accuracy and competency of the data collected by the apparatus. The second testing schedule was of long term to evaluate the apparatus as an on-line automatic monitoring system. The third set of tests was a detailed and short term study of the results collected by the apparatus with respect to other wastewater parameters.

5.1 Tests to Calibrate The Apparatus

The competency of the system's operation and the accuracy of its collected data values were examined during this preliminary testing program. The DO and temperature measurement of the Automated Oxygen Uptake Rate measurement system were tested against two portable DO meters, random Winkler DO measurement and a thermometer. A typical set of data collected by these methods is shown in Appendix A; Figures A1, A2, A3, and A4. All the preliminary test runs were conducted on tapwater. The samples were first aerated to increase their available dissolved oxygen and then the oxygen was slowly scrubbed using nitrogen (N_2) gas.

A high correlation of +0.994 to +0.998 was found in comparing over eighty DO data values measured by the OUR apparatus, the DO meters and the Winkler method. The correlation between the temperature readings collected by the apparatus and a thermometer was +0.996. This consistent, close relation of the results illustrates the accuracy of the system.

The samples' temperatures were also varied during the calibration test runs and were measured by the apparatus and a thermometer. These data points also agreed well with one another, as shown in the above mentioned figures.

After the preliminary test runs the apparatus was moved to the Gold Bar Treatment Plant for actual testing and data collection.

5.2 Long Term Tests

The OUR apparatus was moved to the Gold Bar Wastewater Treatment Plant on March 25, 1985 and was set up at the aeration tank No.4. The sampling line was connected to the end of the first pass of the aeration tank. At the head of the aeration tank, return sludge and primary effluent enter the tank and are well mixed before sample intake. The plan view of the aeration tank and the sampling location is shown in Figure 5.1.

The automated OUR measurement system was tested for a period of six months at this location. During the six months, the apparatus operated for continuous runs of three to five day periods. The operation was only stopped to calibrate the DO meter and as a result of occasional electrical power failures at the plant.

During the first three weeks at the Gold Bar wastewater treatment plant, the apparatus was calibrated every day against a portable DO meter; however, later, calibrating the apparatus twice every week proved to be sufficient. To calibrate the apparatus it was found that the device had to be adjusted between 0.1 to 0.7 mg/l DO each time. This small adjustment is normal for most commercial DO meters.

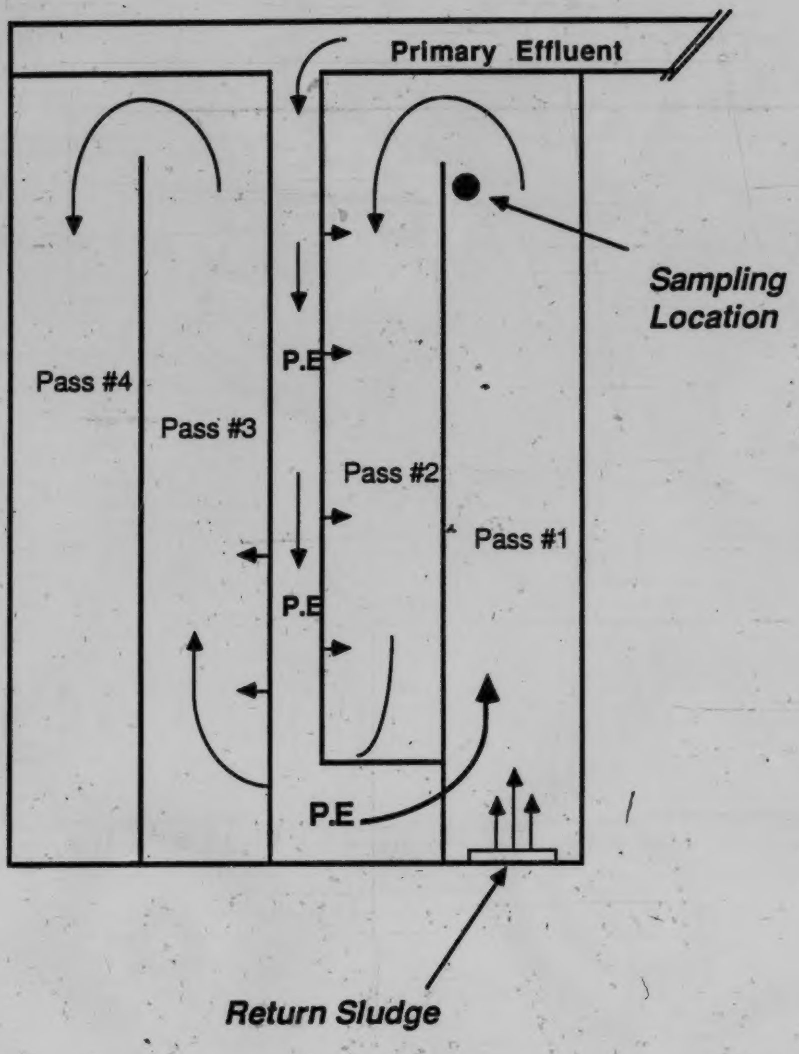

Primary Effluent
Pass #4
Pass #3
P.E
Pass #2
Pass #1
P.E
P.E
Sampling Location
Return Sludge

Figure 5.1 Plan View of The Gold Bar Aeration Tank and Sampling location.

A problem which was noted during the long term study, was the operation of the DO probe. As a result of the long term contact of the probe with the activated sludge sample, the anode (silver) part of the probe was tarnished and became less sensitive. This did not effect the OUR measurements because the probe was periodically calibrated, however the probe had to be replaced every two months. One aspect of the apparatus which needs more study is finding of a new probe that can withstand the long term, continuous testing with the activated sludge samples or examine a quick and inexpensive method of generating the DO probe for reuse. The DO probe used on this apparatus was manufactured by YSI Ltd.

5.2.1 Long Term Collected Data

During the first three weeks of the operation at the Gold Bar wastewater treatment plant preliminary test runs were conducted to consider different testing time durations and measurement intervals of the samples' DO and temperature values. From these experimental runs it was noted that the maximum available dissolved oxygen reached as a result of aeration, was between 7 to 9 mg/l DO, and that the dissolved oxygen available in the sample was exhausted within 15 to 25 minutes after the aeration depending on the time of the day. With this information a testing procedure was arbitrarily chosen according to which the long term tests were carried out. The input instructions for the test runs were as follows:

- Total test time of 20 minutes.

  Every 20 minutes a new sample of activated sludge was collected by the apparatus for analysis.

- Total aeration time of 4.1 minute.

  It was found that with 4.1 minutes of aeration the dissolved oxygen in the activated sludge would reach the maximum range of 7 to 9 mg/l.

- DO readings collected every 30 seconds.

  With this interval enough Dissolved Oxygen data points are collected to calculate the Oxygen Uptake Rate of the sample and also it does not overload the system's memory and the disk space.

- Temperature readings collected every 240 seconds.

  This time interval for temperature readings was arbitrarily chosen to spot check the sample's temperature during the test run.

Tables of data and plots of the data points collected during the six month testing period are given in Appendix E. As it was expected, the OUR of the aeration tank does not remain at a constant value throughout the day. From the plots of the data points, a consistent and distinct oscillation of the OUR values during the day and the night time can be noted. This oscillation with a span of twenty four hours, contrary to expectations, reaches its maximum DO at late in the evening, and its minimum DO at approximately midday. The oscillation of the OUR values can be related to the varing hydraulic inflow of the plant. The hydraulic inflow to the plant adjusted for the detention time of five hours prior to sampling location is transposed on top measured OUR values of a continous test run is shown in Figure 5.2. From this plot it can be noted that the changing inflow rate and the oscillation of the OUR values correspond well with one another. During this period a storm passed by Edmonton and as a result of high runoff inflow and higher dilution of wastewater, the OUR values have all dropped.

5.2.2 Operational Analyses

From the six month operation of the apparatus and the large number of data collected in this period, a number of problems and phenomena were noted both with the operation of the apparatus and with respect to the treatment process. The noted problems and phenomena can be listed into three general categories; one being system failures, the second process irregularaties,and the third being the observed process phenomena which may be useful in controlling the treatment process.

5.2.2.1 System Failures

Three types of system failures were noted during the six month operation of the apparatus. These problems consist of mechanical failures, electrical problems, and computer failures.

Mechanical failures such as plugged lines and valves result in sudden change or spike of OUR values.

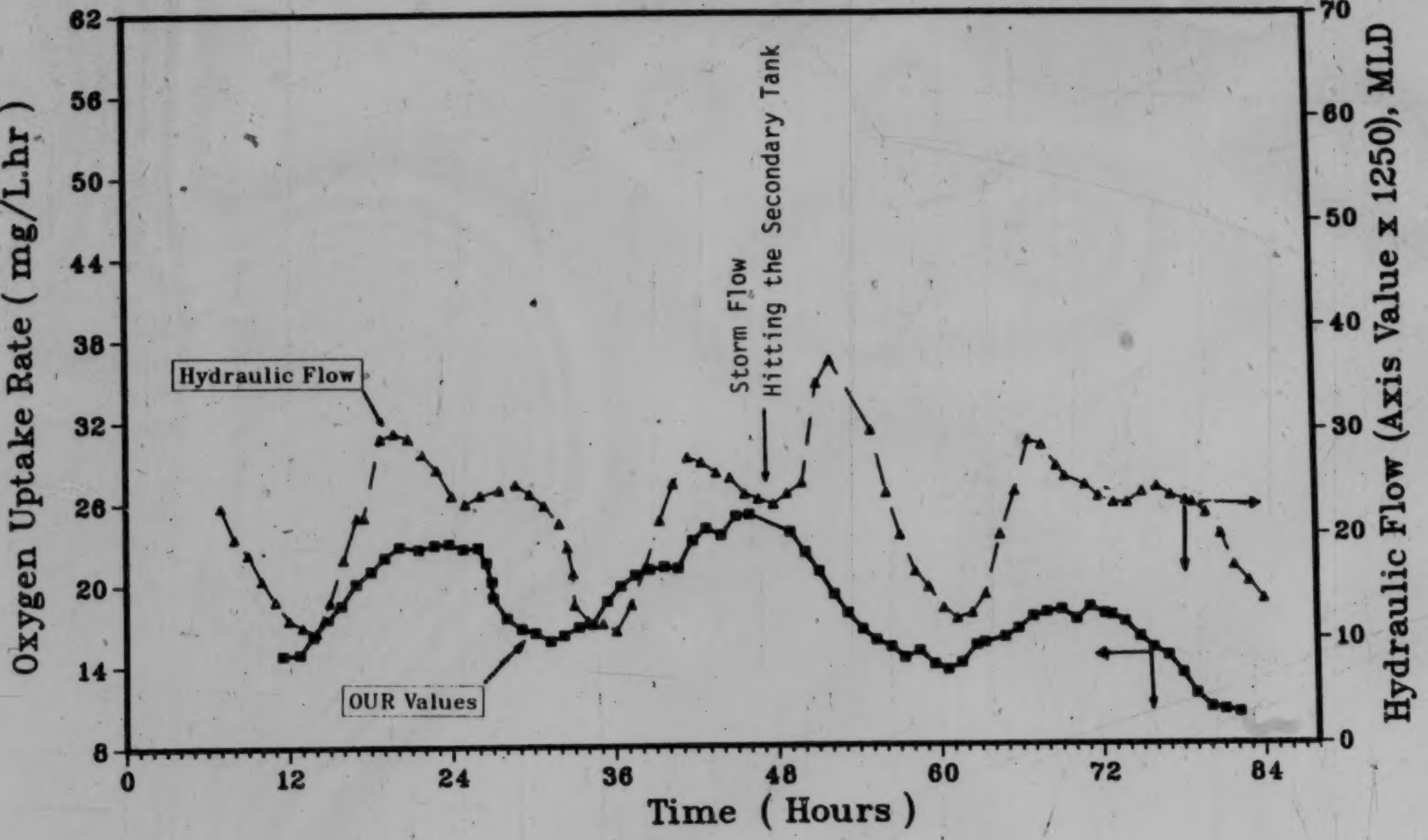


Figure 5.2 Adjusted Hydraulic Flow and OUR Values.

These types of problems can be noted during October 2, 5, August 15, 19, July 2, 19, 20 and etc. (Appendix E). When the sample collection line or the discharge line is plugged, no new sample is collected and the measurement tank will not fill, therefore, as a result of DO probe not having contact with the sample no drop in DO values is registered and the OUR values are calculated to be 0.0 mg/L.hr or close to it.

Another type of mechanical failure was the air compressor and the air line, which resulted in improper aeration of the samples and varying OUR measurements. These types of irregular OUR values can be seen during July 23 to August 5 (Appendix E).

The only electrical problem that was noted with the system was the occasional out of calibration of the DO meter and the missed measurement of the temperature readings. Ocassionally it was found that the system was very much out of calibration. This may be caused by the probe or the electrical system. An example of this out of calibration can be seen on April 18 and September 27 (Appendix E), when the system was calibrated and the following OUR values did not agree with the pre-calibration OUR values which were generally lower. The missed measurement of the temperature values by the apparatus were noted throughout the test runs. The reported temperature readings were generally one to two degrees Celsius higher than the actual temperature. This missed measurement can be related to the electrical system which requires improvement in the future.

The problems with the micro-computer were mostly related to the disk drive and the data registrating system. Occasionally, for no apparent reason, a number of data files were scratched or lost on the magnetic disks. This loss of data files may be explained by disk drive failure or by individuals tampering with the computer system.

5.2.2.2 Process Irregularities

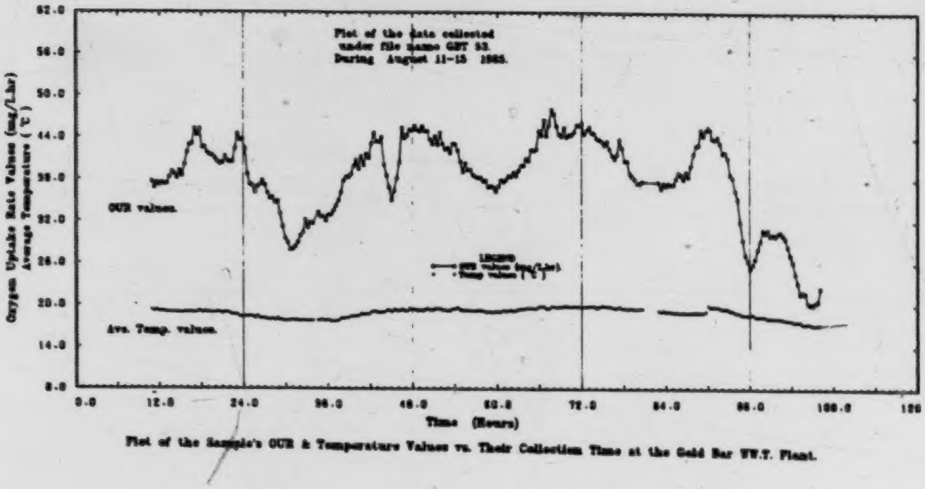
From the data collected during the six month long operation of the apparatus a general daily trend of the varying OUR values can be concluded. This general trend consists of oscillating OUR values with a span of twenty four hours. This oscillation consistently reached its maximum around midnight and its minimum at approximately midday. During the six month operation of the apparatus, on many occasions this general trend of the OUR values was violated which shows an upset of the treatment process. Identification of these occasions to prevent an upset of the treatment process is one of the more obvious and valuable applications of this apparatus. Examples of some of the OUR irregularities and possible process disruptions causing the irregularities are pointed out in the following.

Slug inflow of toxic or inhibitory substances into the treatment plant is a serious type of process disruption. Toxic or inhibitory materials reduce the micro-organisms' activity and their waste utilization abilities. This type of inhibition can be noted from a sudden decrease of the mixed liquor OUR values. Examples of such occurrences can be seen on August,12, 22, July 16 and July 18 (Appendix E). During these dates the OUR values of a group of samples have suddenly decreased which violated the daily trend. In Figure 5.3 a typical example is given. The extent of process disruption caused by the inhibitory substance can be measured by the magnitude and duration of the irregularities of the OUR values.

A second type of process disruption is the inflow of highly biodegradable substances which suddenly increase the OUR of the mixed liquor and overload the treatment process. Examples of such events can be noted from the plots of the data collected on April 10 and June 23 (Appendix E). In Figure 5.3 a typical example is given. The increase of the measured OUR values of a group of samples which violates the regular trend suggests inflow of highly biodegradable substances.

A natural type of disruption in an activated sludge treatment process is the effect of rain/snow fall and runoff. In Edmonton, a portion of the street runoff is directed to the wastewater treatment plant. The sudden increase of the inflow and the street runoff, which carries with it both toxic materials and biodegradable

Effect of Toxicity or Inhibitory



Effect of Increased Biodegradables

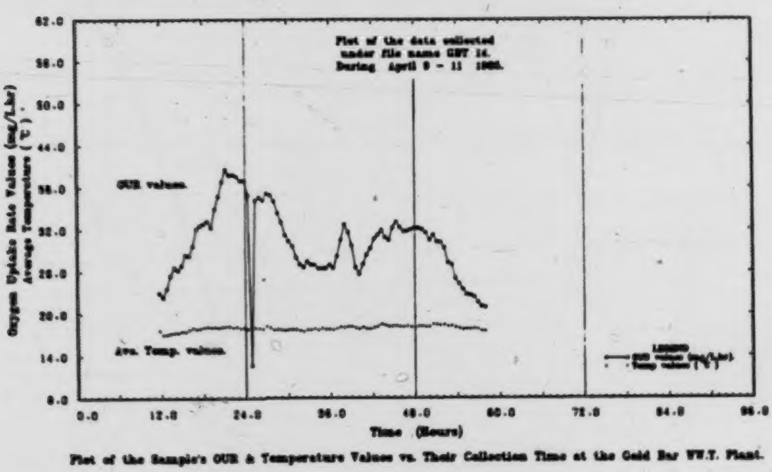


Figure 5.3 Typical example of OUR irregularities which may be related to slug of toxic and highly biodegradabale materials.

materials, cause disturbance of the treatment process. After a storm, usually lower OUR values in a mixed liquor are noted. This can be related to higher dilution of wastewater, lower temperatures, and street washout. A clear example of lower measured OUR values after a storm is illustrated in Figure 5.2. In this figure, the hydraulic inflow and the measured OUR values before and after a storm period are plotted on top of one another. Other examples of the decreasing OUR values as a result of rainfall can be noted during May 24-25, June 13-15, 23-24, July 16, and August 14-15 (Appendix E). Disruption of the OUR values in an activated sludge treatment process caused by precipitation and runoff are easily detected with this type of automated OUR monitoring system.

In general, detection of process problems and irregularities which have an effect on the OUR values of the mixed liquor are made possible through the automated OUR measuring system. Identification of such irregularities and responding to their cause before they can upset the treatment process will result in a more stable and efficient operating treatment plant.

5.2.2.3 Process Phenomena

From the data collected during the six month operation of the apparatus and monitoring of the mixed liquor OUR values at the Edmonton activated sludge treatment plant, three distinct and expected trends of

OUR variations were noted. One was the daily trend and variation of the OUR values which has already been discussed in some detail. Second is the weekly variation of the OUR values and thirdly, the seasonal variation of the OUR values.

Weekly variation of the OUR values indicate that in general the OUR values of the mixed liquor are measured to be higher during the week in comparison to the measured values on the weekend. This trend can be related to the higher inflow volumes during the week and lower inflows on the weekend. A prime example of the weekly trend of the OUR values is shown in Figure 5.4. The plot of the data during the two week span of May 9 to May 16 show a lower maximums and minimum OUR values on Saturday and Sunday with respect to the rest of the week.

The seasonal variation of the OUR values is evident by the lower OUR values during the spring and higher OUR values during the summer time. This seasonal variation of the OUR values can be attributed to the seasonal variation of the inflow wastewater. During the spring, as a result of high rain fall, snow melt and street runoff, the inflow is diluted, and at a low temperature; therefore, lower OUR values are expected. Where as, in the summer time, the inflow wastewater is more concentrated with higher temperatures, and higher OUR values are expected. The summary of the seasonal

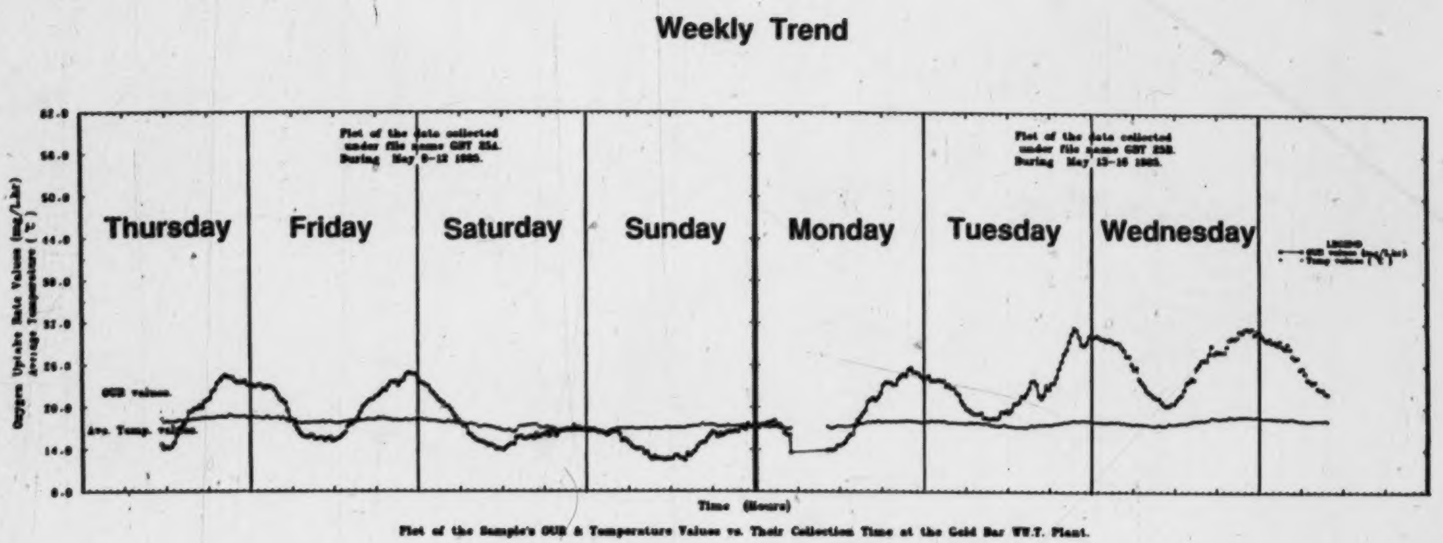


Figure 5.4 Weekly Trend of The OUR Variation.

variation of the OUR values in the aeration tank, noted during the six month operation of the apparatus is given in Table 5.1. It is expected that during the fall and winter the mixed liquor OUR values will decrease because of lower temperatures and higher precipitation.

Adjustment of the treatment process to meet the needs of the OUR trends and variations can prove to be very important in reducing the annual process costs and improving the effluent quality. An obvious type of control is the adjustment of the blowers in an aeration tank. The blowers can be adjusted to aerate the mixed liquor with a high intensity during high OUR demands and at lower intensity during low OUR demand. This control of the blowers can cut down on the cost by efficient use of electrical power. Controlling the aeration intensity will also reduce the overloading problems of the treatment plant which are caused during high OUR demands, hence, improvement of the effluent quality will result.

5.3 Short And Detailed Testing Program

This testing schedule featured a short, detailed study of the OUR values measured by the apparatus in relation with the more common parameters of wastewater examination and analysis. For a period of eighteen hours during the operation of the OUR apparatus samples were collected every two hours for analysis. Mixed liquor samples were collected

Table 5.1 Seasonal Variation of The OUR Values.

Seasonal Trends

		OUR (mg/L.hr)		
		Ave	Max	Min
April - mid June	**(spring)**	**22-27**	**30-35**	**15**
July - Oct.	**(summer)**	**32-37**	**50**	**25**

from the end of the first pass of the aeration tank. The samples were examined for filtered and unfiltered BOD, suspended solids (SS), volatile suspended solids (VSS), and manual OUR measurements. Figure 5.5 illustrates all the data collected during this intensive testing period. The top graph presents the relationship beteen OUR values measured manually and those collected by the apparatus. The manual and automated measured OUR values corresponded well with one another. The adjusted hydraulic flow variation, the filtered and unfiltered BOD, SS, and VSS measurements of the samples collected in conjunction with the operation of the apparatus are also shown in this figure.

The objectives behind this set of tests were; one, to confirm the reliability of the OUR values measured by the apparatus with those of manual measurements. Secondly, to record the changes in the common parameters of wastewater analysis with respect to the variation of the OUR values and thirdly, to explain the OUR variations of the mixed liquor with the aid of more detailed study of the wastewater characteristics.

The accuracy of the OUR values measured by the apparatus is confirmed from the close agreement of the OUR values collected by the apparatus and those of manual measurements. However there were no confirmed relationships established between the OUR measurements and the common parameters of wastewater analysis such as filtered and unfiltered BOD, SS, and VSS values in our study. In general

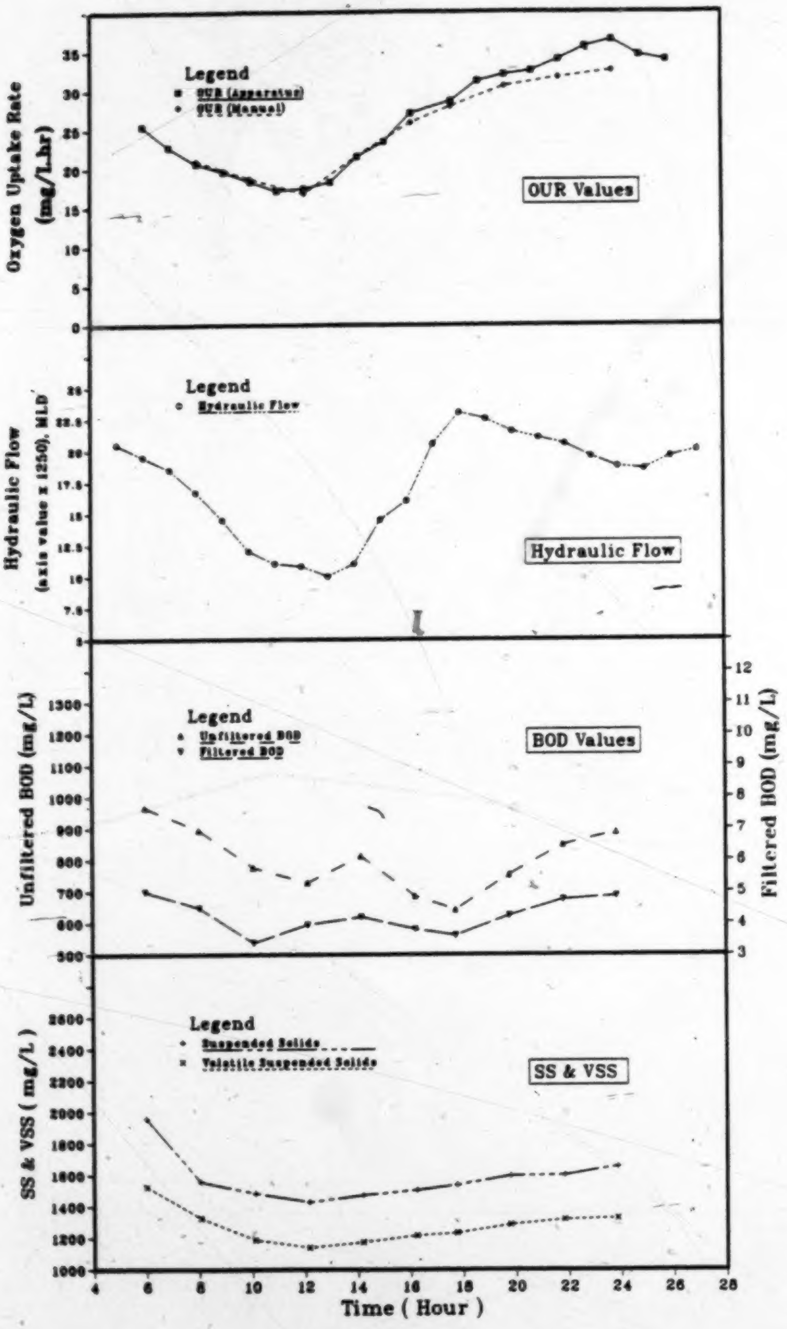


Figure 5.4 Data Collected During The Intensive Test Period.

it can be said that the variation of these parameters are in direct relationship with the OUR variation of the aeration tank.

To identify any confirmed relationship between these parameters and the OUR variations it is recommended that longer studies of this type be carried out with a more intensive and detailed analysis of the data points. Finding such a relationship was notwithin the scope of this study, therefore, the data values were not analyzed in detail.

6. Summary

From the literature review of the oxygen uptake rate (OUR) measurement in an activated sludge treatment process it can be concluded that this parameter has been widely investigated by researchers and has been acknowledged to accurately reflect the microbial activity in an activated sludge treatment process. This parameter is also been reported to be an excellent tool in monitoring and controlling an activated sludge treatment process (Block, 1976; Benefield, et al., 1975; Mona, et al., 1979; Andrews, 1977; Huang and Cheng, 1984). There are many advantages in using this parameter as an on-line monitoring tool which have been discussed in the thesis.

Routine on-line measurement of the oxygen uptake rate values in an activated sludge treatment process has not been possible until the development of the automated oxygen uptake rate measurement system which has evolved from this study. The objectives which were considered in the design of this system are:

1. Total Automation

   The system automatically on a routine basis collects a volume of sample and measures its OUR value. The measured values are then stored by the apparatus for future study or immediate monitoring of the treatment process.

2. Measurements according to Standard Methods.

   This gives some credibility to the measured OUR values as a controlling parameter in the treatment plant.

To meet the objectives in design of the automated oxygen uptake rate measurement system, a combination of mechanical, electrical and computer systems were used. The operation of the apparatus is controlled with the aid of a software program operated through the micro-computer. The software program interactively collects all the required instructions to operate the apparatus from the operator. Then the program instructs the apparatus to collect a volume of sample, aerate the sample while it is being mixed, and after the aeration period, measure and store the dissolved oxygen and temperature of the sample, all according to the input instructions of the operator. The OUR value of the sample is calculated from the dissolved oxygen readings. The design details of the apparatus and the software program as well as the operation schedule of the system is given within the thesis.

The designed oxygen uptake rate measurement system was evaluated through three different testing schedules;

1. Calibration Test

   To confirm the reliability of the OUR measurements obtained by the apparatus.

2. Long term tests or field experiment.

   For a period of six months the apparatus was put into operation at the City of Edmonton's Gold Bar Sewage Treatment Plant. The objective of this testing schedule was to evaluate the system as a long term routine monitoring unit.

3. Short and detailed tests.

   For a period of 18 hours in conjunction with the operation of the apparatus, samples were collected and analyzed for filtered and unfiltered BOD, suspended solids, voltile suspended solids, and manual OUR measurement. The objective of this set of tests was to record the changes of the more common parameters of activated sludge treatment process with respect to the variation of the OUR values.

Some very interesting observations were concluded from the long term testing period, the details of which are discussed in the conclusions.

7. Conclusions

The conclusions that can be made from this study are:

1. Oxygen uptake rate measurement in an activated sludge treatment process is an excellent monitoring tool for the treatment process. This was concluded from the literature review.
2. The designed Automated Oxygen Uptake Rate Measurement System is:
    a. Reliable both in measuring the OUR values of the samples and the operation technique.

       This can be concluded from the calibration tests during which the accuracy of the measurements collected by the system was investigated. The system's operation was evaluated by the multitude of test runs.
    b. Able to withstand long continuous testing periods.

       The apparatus is totally automated in collecting sample, measuring its OUR value, and storing the measured value. This was one of the design objectives of the system which would qualify the system as an on-line monitoring unit. This feature of the system was confirmed from the six months of continuous, low maintenance operation of the apparatus at the Edmonton Gold Bar Sewage Treatment Plant.

c. Good as a monitoring system in an activated sludge treatment process.

From the six month field operation of the system observations such as daily trends, weekly trends and seasonal variation of the OUR values were noted, which may be helpful in monitoring an activated sludge treatment plant. Irregularities to these trends were also identified throughout the study. These irregularities were related to the variation of the inflow such as the possible inflow of toxic materials or the increase in biodegradable concentrations. Monitoring and resolving the cause of these irregularities before they can affect the treatment process can be helpful in operating a stable treatment plant.

3. Observations that were concluded from the examination of the data values collected during this study include;

a. Daily trend of the OUR variation at the sampling site.

The OUR values in a 24 hour period were consistently noted to vary in an oscillating manner with a span of approximatly 24 hours and its minimum occurring at about midday, and maximums at approximately midnight. This oscillation was found to be in direct relation with the hydraulic flow at the sampling site.

b. Weekly trend of the OUR vartiations.

During some weeks it was noted that the daily oscillation of the OUR values consist of higher maximums and minimums during the weekday in comparison to the daily oscillations on the weekends. This can be related to the more concentrated inflows occurring during the weekday with respect to the weekends.

c. Seasonal variation of the OUR values in an aeration tank.

During the months of April to mid-June an average OUR value of 22 to 27 mg/L.hr with maximums of 30 to 35 mg/L.hr and minimums of 15 mg/L.hr were noted. However, during the months of July to October average OUR values were noted to be 32 to 37 mg/L.hr, with maximumxs of 50 mg/L.hr and minimums of 25 mg/L.hr. This general difference of the OUR values can be related to the seasonal variation of the inflow. During Spring, between months of April to June, there are precipitation and spring run-off causing a more diluted inflow and lower temperatures, therefore, lower OUR values are expected. During the summer the inflow is much more concentrated and at higher temperatures, therefore, higher OUR values are found.

This distinct seasonal variation of the OUR values suggests the need for seasonal adjustment of the aerators to reduce operation costs.

d. Irregularities to the observed trends.

Occasional irregularities to the above mentioned trends were noted which according to literature can be related to, inflow of toxic materials, sudden increase of biodegradable materials or storms and street washouts entering the plant and effecting the process.

8. Recommendations

Two major recommendations can be made from this research during which an automated oxygen uptake rate measurement system was designed and evaluated. These recommendations are as follows:

1. Further study and analysis of the collected OUR values.

During this study a tremendous number of data values were collected. However, the scope of this thesis did not allow for detailed study and analysis of the OUR data values. It is recommended that a detailed study of these data points be carried out. During this analysis the variation of the OUR values in the aeration tank can be studied with respect to different components of the activated sludge treatment process.

The collected OUR data values during the six month operation of the apparatus at the Edmonton Gold Bar Sewage Treatment Plant shows a very consistent oscillating variation. This suggests an analytical study of the variation to determine a formulated expectancy of the OUR values in an aeration tank. Finding of this relation can be very useful in monitoring and controlling an activated sludge treatment process.

Another recommendation under this category is to study the relation of the OUR variations in an aeration tank with respect to other parameters of wastewater, such as BOD, SS, and VSS. An attempt of such a study was done in this research however no relations were found.

It is suggested that longer tests and more intensive analysis are needed before any conclusions can be made.

2. Future development of the system and its use as an on-line monitoring tool in an activated sludge treatment plant.

The initial design of the Automated Oxygen Measurement system is more of an experimental design. This system has to be refined before it can be used as an on-line monitoring unit. Further development of this system is highly recommended.

The automated OUR system is recommended to be used as an on-line monitoring unit in an activated sludge treatment process to --

a. Detect influent toxicity.

   By locating this system at the head of the treatment plant and sampling inflow (either raw, or a mixture of raw and activated sludge) and by measuring the OUR of samples, any irregularities caused by toxic materials can be identified. By identifying these irregularities early, the operator will have plenty of time to reroute the slug of toxic materials before it can enter the aeration tanks and upset the treatment process; or adjust the treatment process to overcome the problem.

b. Stabilize the treatment process resulting in

   1) Consistent effluent quality.

2) Lower operation costs.

Through on-line and automatic monitoring of the OUR value and meeting it's demands in an aeration tank the overloading of the tanks can be eliminated to improve and stabilize the effluent quality. Also, during low OUR demands the intensity of the blowers can be reduced, resulting in the saving of operation costs.

BIBLIOGRAPHY

Adams, C.E. Jr., Ford, D.L., and Eckenfelder W.W. Jr. 1981. Development of Design and Operational Criteria for Wastewater Treatment, Enviro. Press Inc. Nashville, Tenn., pp 493.

Andrews, J.F. 1977. Specific Oxygen Utilization Rate for Control of The Activared Sludge Process. Prog. Wat. Tech., 8, 6, 451-460.

Ang, A.H. and Tang, W.H. 1975, Probability Concept in Engineering Planning and Design, John Wiley & Sons, Inc. Toronto, Onterio. pp 409.

Arthur, R.M. 1983. Procedures and Practices in Activated Sludge Process Control, Butterworth Publishers, Woburn, MA. pp 226.

Arthur, R.M. 1982. Application of On-line Analytical Instrumentation to Process Control, Ann Arbor Science Publishers, Ann Arbor, Michigan, pp 222.

Arthur, R.M. 1982. New Concept and Practice In Activated Sludge Process Control, Ann Arbor Science Publishers, Ann Arbor, Michigan, pp 25.

Ben-Yoakov, S., and Ben-Asher, Y. 1982. Continuous Measurement of Dissolved Oxygen in Water Culture by a Selfe-Calibratind Monitor. Water Research, 16, 169-172.

Benefield, L.D. and Randall C.W. 1980. Biological Process Design for Wastewater Treatment, Prentice-Hall Inc., Englewood Cliffs, NJ. pp 526.

Benefield, L. D., et al. 1975. Process Control by Oxygen Uptake Rate and Solids Analysis. J. Water Pollut. Control Fed.,47, 10, 2498-2503.

Blok, J. 1976. Measurement of The Viable Biomass Concentration in Activated Sludge by Respirometric Techniques. Water Research, 10, 919-925.

Blok, J. 1974. Respirometeric Measurement on Activated Sludge, Water Research, 8, 11-18.

Brouzes, P. 1968. Automated Activated Sludge Plants With Respiratory Metabolism Control. Fourth International Conference on Water Pollution Research Prague, pp 12.

Clifft, R. C., and Andrew, J. F. 1981. Predicting The

Dynamics of Oxygen Utilization in The Activated Sludge Process. *J. Water Pollut. Control Fed.*, *53*, 7, 1219-1234.

Dobbins, W.E. 1977. Computer Applications in Automation. *Research Needs for Automation of Wastewater Treatment Systems.* Edited by Buhr, H.O., Andrews J.F. and Kenneth T.M. 99-111.

Duggan, J. B. and Cleasby, J. L. 1976. Effect of Variable Loading on Oxygen Uptake. *J. Water Pollut. Control Fed.*, *48*, 3, 540-550.

Eckenfelder, W.W. Jr., and Jaffee, P.R. 1982. Efflluent Quality Control in The Activated Sludge Process Using Oxygen Uptake Rate. *Environmental Technology Letters*, *3*, 10, 441-448.

Eckenfelder, W.W. Jr. 1970. *Water Quality Engineering for Practising Engineers.* Barnes and Noble, Inc., New Yourk,NY.

Eckenfelder, W.W. Jr. 1967. Comparative Biological Waste Treatment Design. *Jour. San. Eng. Div., Proc. Amer. Soc. Civil Engr.*, *93*, SA6, 157.

Edwards, G.L., and Sherrard, J.H. 1982. Measurement and Validity of Oxygen Uptake As An Activated Sludge Process Control Parameter. *J. Water Pollut. Control Fed.*, *54*, 12, 1546-1552.

Ekama, G.A., and Marais, G.V.R, 1979. Dynamic Behaviour of the Activated Sludge Process. *J. Water Pollut. Control Fed.*, *51*, 3, 534-556.

Environmental Protection Agency, 1971, *Oxygen Consumption in Continous Biological Culture*, Center For Research, Inc. University of Kansas, Kansas, pp 130.

Ford, D.L. and Eckenfelder, W.W. Jr. 1967. Effect of Process Variableon Sludge Flow Formation and Settling Characteristics. *J. Water Pollut. Control Fed.*, *39*, 11, 1850-1859.

Fujimoto, E., Iwahori, K., and Sota, N. 1981. Automatic Measurement Device of the Respiration Rate and Experimental Investigation on the Constant DO Control By Using the Device for the Activated Sludge Process. *Wat. Sci. Tech.*, *13*, 9, Muncih, 193-198.

Ganczarczyk, J.J. 1983. *Activated Sludge Process, Theory and Practice*, Marcel Dekker Inc., New Yourk, NY., pp 270.

Giona, A.R. and Annesini, M.C. 1979. Oxygen Uptake in The

Activated Sludge Process. J. Water Pollut. Control Fed., 51, 5, 1009-1016.

Hass, C.N. 1979. Oxygen Uptake Rate As An Activated Sludge Control Parameter. J. Water Pollut. Control Fed., 51, 5, 938-943.

Hammer, M.J 1977, Water and Wastewater Technology, SI Version, John Wiley & Sons, Inc. pp 504.

Huang, J.Y.C., Cheng, M.D. and Mueller, J.T. 1985. Oxygen Uptake Rate for Determining Microbial Activity and Application. Water Research, 19, 3, 373-381.

Huang, J.Y.C. and Cheng, M.D. 1984. Measurement and New Applications of Oxygen Uptake Rates in Activated Sludge Processes. J. Water Pollut. Control Fed., 56, 3, 259-265.

Joyce, R.J., et. al. 1974. How to Optimize and Activated Sludge Plant. Water and Sewage Works, 121, 10, 96-99.

Junkins, R., Deeny, K., and Eckhoff, T. 1983. The Activated Sludge Process: Fundamentals of Operation, Ann Arbor Science Publishers, Ann Arbor, Michigan, pp 136.

Kalinske, A.A., 1971. Effect of Dissolved Oxygen and Substrate Concentration on the Uptake Rate of Microbial Suspension. J. Water Pollut. Control Fed., 43, 1, 73-80.

Kennedy J.B. and Neville, A.M. 1974, Basic Statistical Methods For Engineers & Scientists. Harper and Row Publishers, Inc. New Yourk, N.Y., pp490

Khararjian, H.A. 1980. Oxygen Uptake as a Control Parameter. J. Water Pollut. Control Fed., 52, 4, 823-824.

Knudson, M.K., Williamson, K.J. and Nelson, P.O 1982. Influence of Dissolved Oxygen on Substrate Utilization Kinetics of Activated Sludge. J. Water Pollut. Control Fed., 54, 1, 52-60.

Kohne, M. 198~~5.~~ Practical Experiences With a New On-Line BOD Measuring Device. Environmental Technology Letters , 6, 12, 546-555. Metcalf & Eddy, Inc. 1979. Wastewater Engineering, Disposal, Reuse, Second Edition. McGraw-Hill, Inc. pp 920.

McKinney, R.E. 1981. Testing Aeration Equipment in Conventional Activated Sludge Plants. J. Water Pollut. Control Fed., 53, 1, 48-58.

Metcalf and Eddy, Inc. 1981, Wastewater Engineering: Collection and Pumping of Wastewater, McGraw-Hill, Inc.

New Yourk, NY. pp 432.

Mona, R., et. al. 1979. Activated Sludge Process Dynamics With Continuous Total Organic Carbon and Oxygen uptake Measurements. Biotechnol. Bioeng., 21, 1561-1577.

Ohto, T., et. al., 1977. Experience of Dissolved Oxygen Control of a Diffused Air Aeration Plant. Wat. Sci. Tech., IAWPR Workshope on Instrumentation and Control For Water and wastewater, London.

Patterson, J.W. 1971. Modes of Toxicity Analysis in Activated Sludge. American Chemical Society. Division of Water, Air and Waste Chemistry. Preprints of Papers Presented at the 161st National Meetings, Los Angeles, California, 11, 1, 24-30.

Patterson, J.W. 1971. Modes of Toxicity Analysis in Activated Sludge. Preprint American Chemistry Society Division of Water, Air and Waste Chemistry.

Sewyer, C.N. and McCarty P.C. 1978, Chemistry For Environmental Engineering, Third Edition, McGraw-Hill, Inc. pp 532.

Schlegel, S. and Lohmann, J. 1981. Control of Dissolved Oxygen in Activated Sludge Plants. Wat. Sci. Tech., 13, 9, Munich, 225-232.

Schulzes, K.K. and Kooirtra, R.D. 1969. Oxygen Demand and Supply in an Activated Sludge Plant. J. Water Pollut. Control Fed., 41, 10, 1763-1774.

Sekaulov, I. and Heinrich, D. 1981. The Continuous Oxygen Uptake Rate Measurement and Its Application As An Activated Sludge Control Parameter. Wat. Sci. Tech., 13, 9, Munich, 205-210.

Sherrad, J.H. 1980 Oxygen Uptake Rate As An Activated Sludge Control Parameter. J. Water Pollut. Control Fed., 52, 7, 2033-2036.

Standard Methods for the Examination of Water and Wastewater, 1980, American Public Health Association 15 ed. pp 1134.

Stenstrom, M.K. and Andrews, J.F. 1979. Real Time Control of the Activated Sludge Process. Journal of The Environmental Engineering, Proceedings of American Society of Civil Engineers., 105, 245-260.

Walter, I. and Davies, M. 1977. The Relationships Between Viability and Respiration Rate in The Activated Sludge Process. Water Research, 11, 575-578.

Weddle, C.L. and Jenkins, D. 1971. The Viability and Activity of Activated Sludge. Water Research, 5, 621-640.

Williamson, K.J. and Nelson, P.O. 1981. Influence of Dissolved Oxygen On Activated Sludge Viability. J. Water Pollut. Control Fed., 53, 10, 1533-1540.

Workshop Summary 1980. Automation of the Activated Sludge Process, Wastewater Technology Center, Burlington, Canada, pp 5.

Young, J.C. 1981. Specific Oxygen Demand as an Operating Parameter for Activated Sludge Processes. Wat. Sci. Tech., 13, 397-403.

Umbreit, W.W., Burris, R.H. and Stauffer, J.F. 1972. Manometric and Biochemical Techniques, 5th Edition. Burgess Minneapolis, Minnesota.

Zarnett, G.D. 1980. Automatic Control for Watewater Treatment Systems. Ministry of Environment Ontario, Report NO:80.

APPENDIX A. Results of The Calibration Test Runs.

This Appendix containes the plots of the data collected during the calibration test run of the apparatus. The objective of these tests was to confirme the accuracy of the measurements collected by the apparatus with respect to other measurement techniques. To meet this objective, the OUR values and temperature measurements collected by the apparatus were ploted with respect to manual measurement techniques of these values. These plots are illustrated by Figures A1, A2, A3, and A4 of this Appandix.

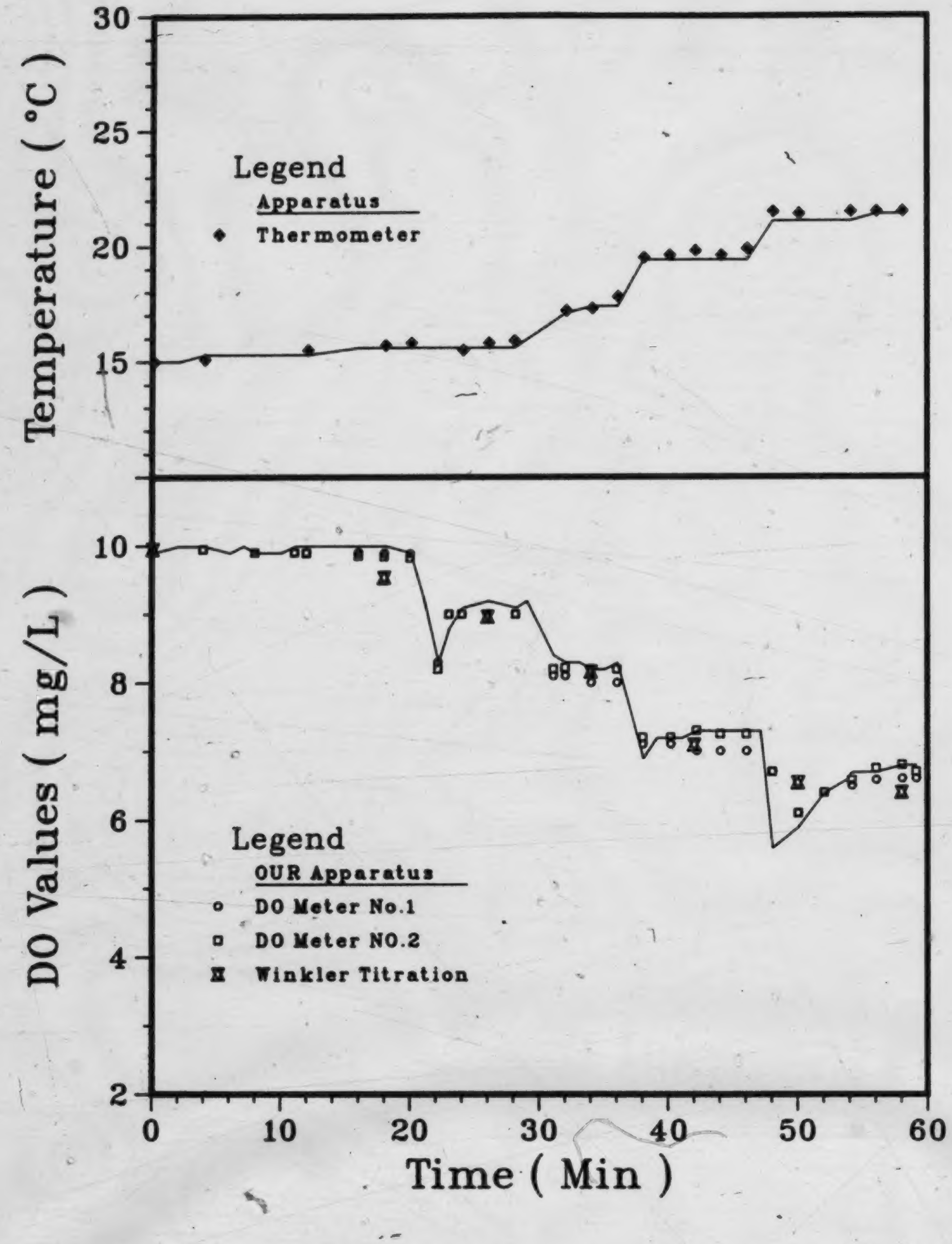


Figure A1. DO and Temperature Calibration Tests of The Apparatus

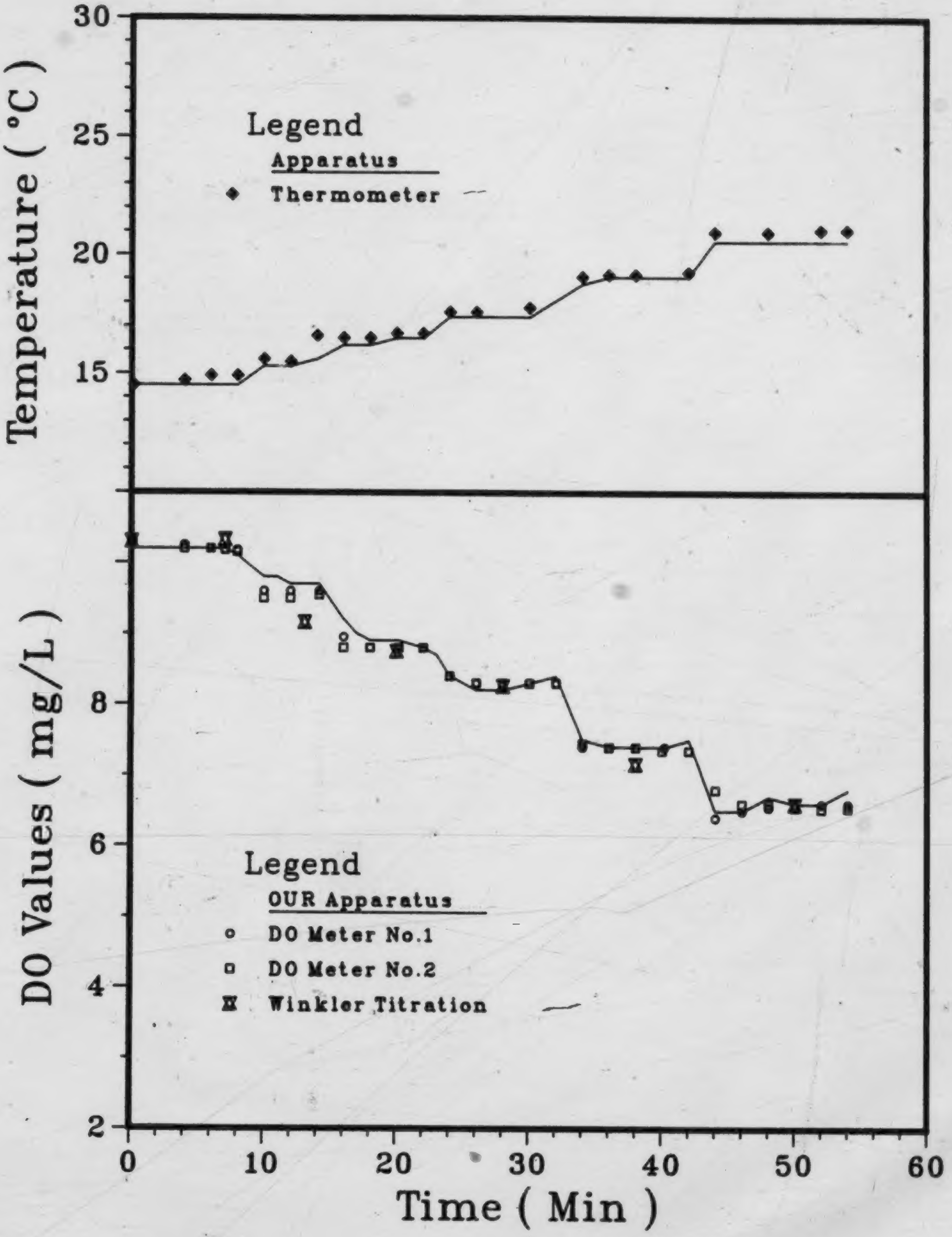


Figure A2. DO and Temperature Calibration Tests of The Apparatus

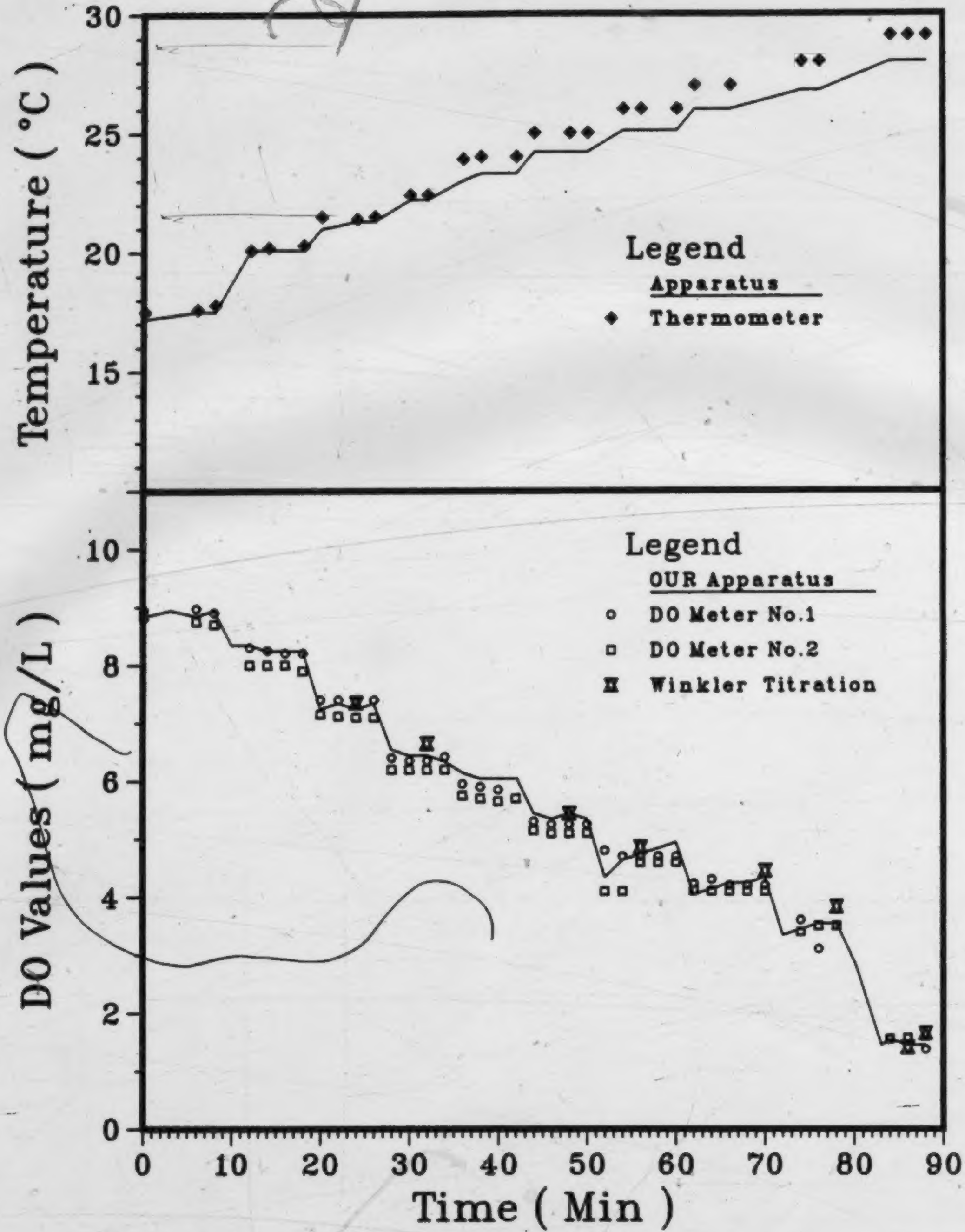


Figure A3. DO and Temperature Calibration Tests of The Apparatus

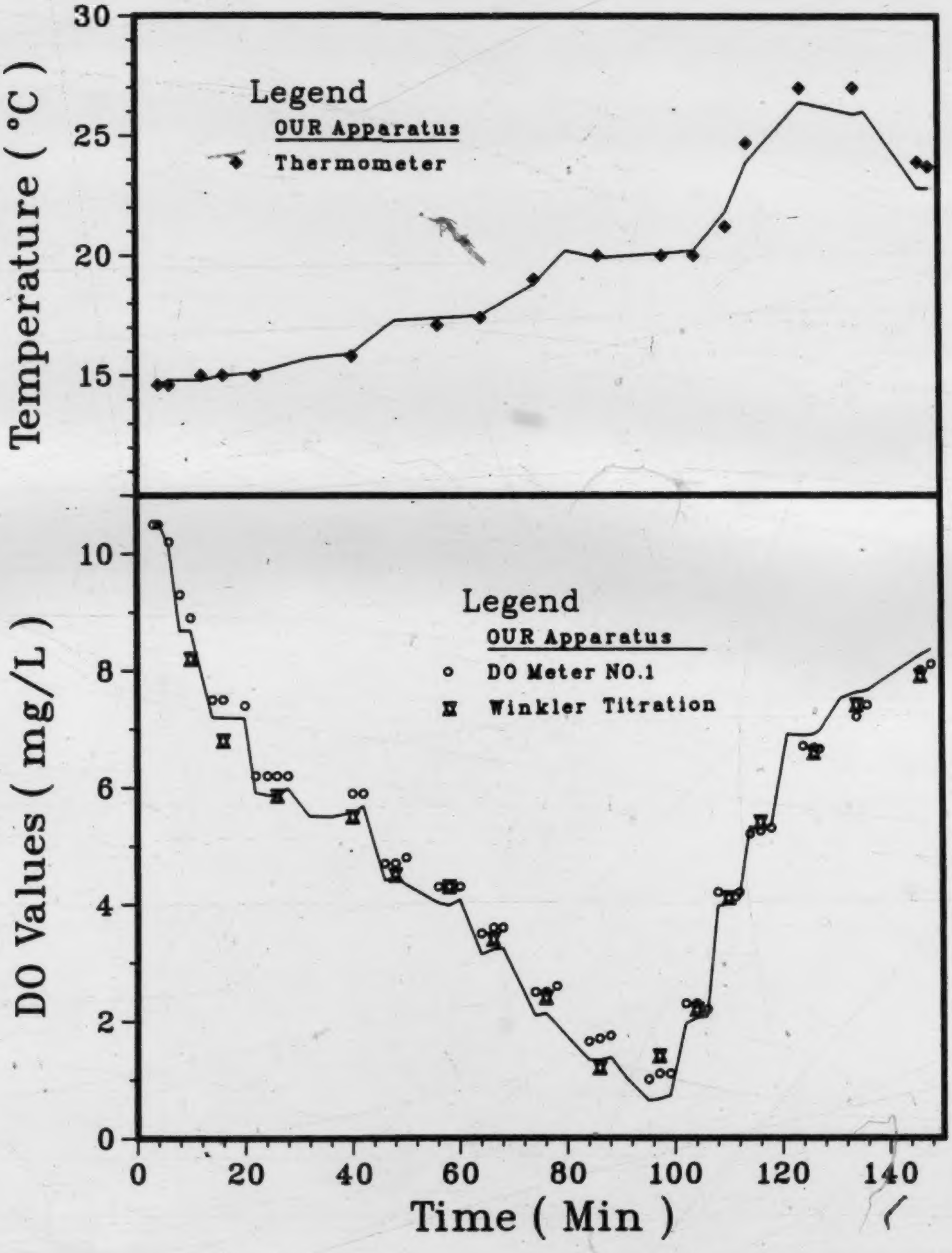


Figure A4. DO and Temperature Calibration Tests of The Apparatus

Appendix B. Flowchart and Listing of The programes.

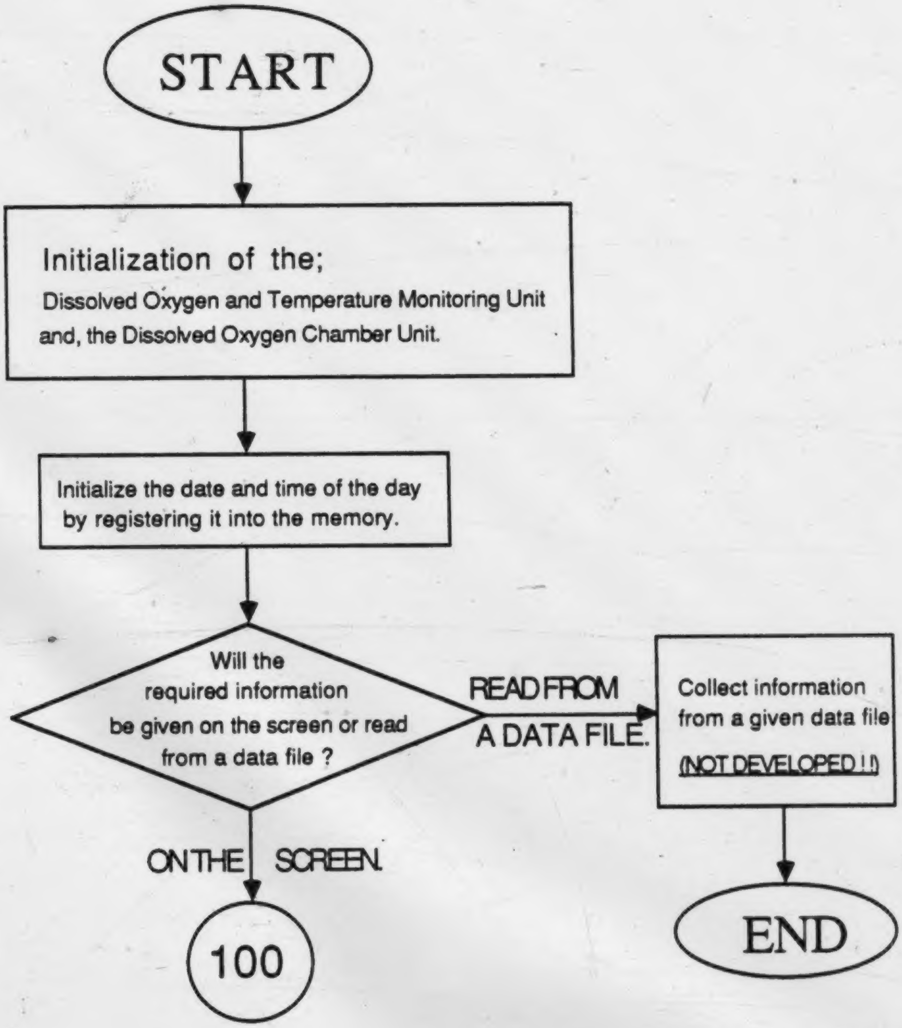
The flowchart and listing of the computer programs developed in this study are given in this Appendix. The order of appearance is as follows:

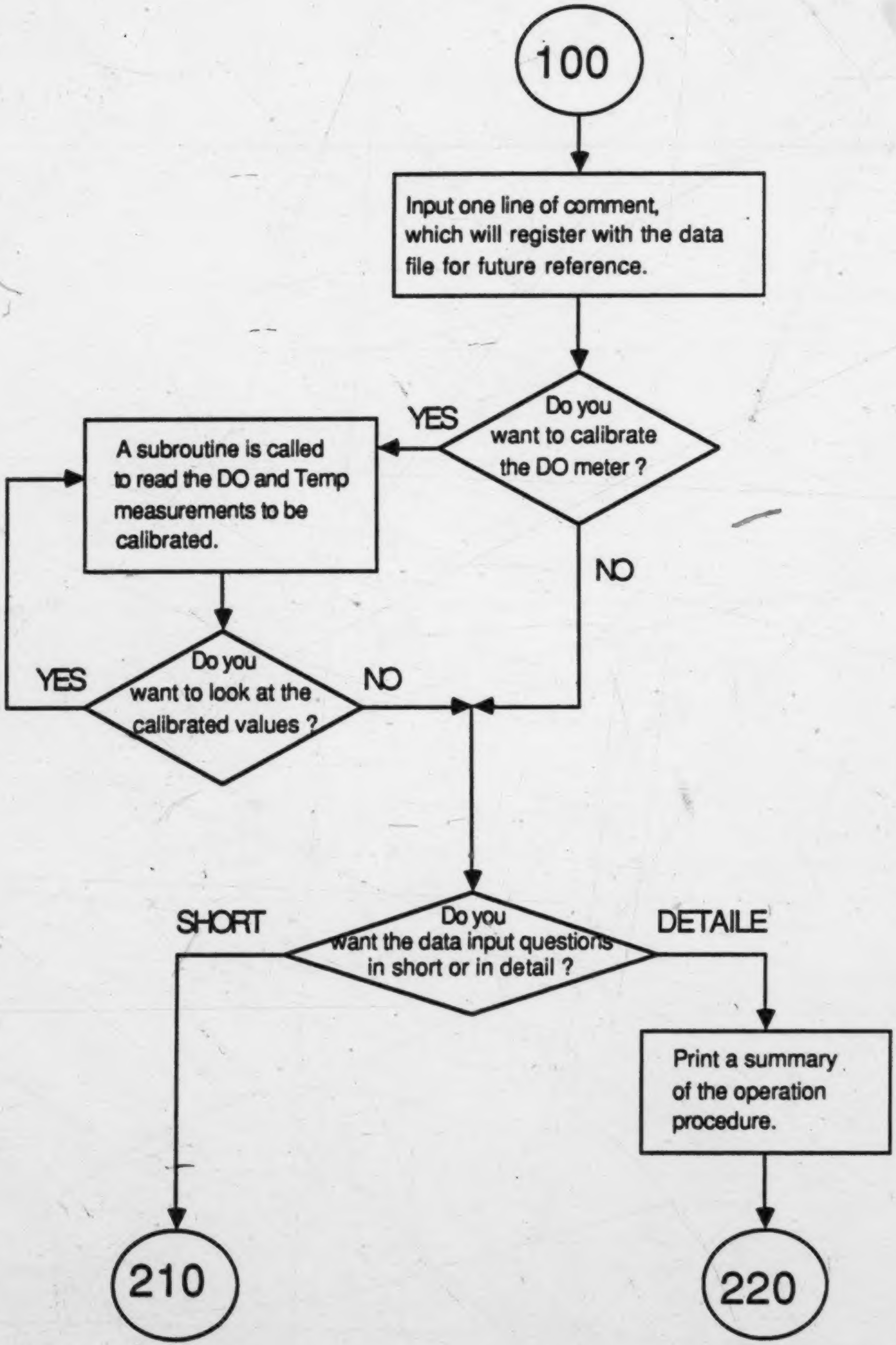
Section	Flowchart & Listing
B1.	OUR.OPERATION
B2.	BA.PRINTOUT
B3.	BA.SUMMARY
B4.	DTD.CONDENSER
B5.	OUR.PLOT

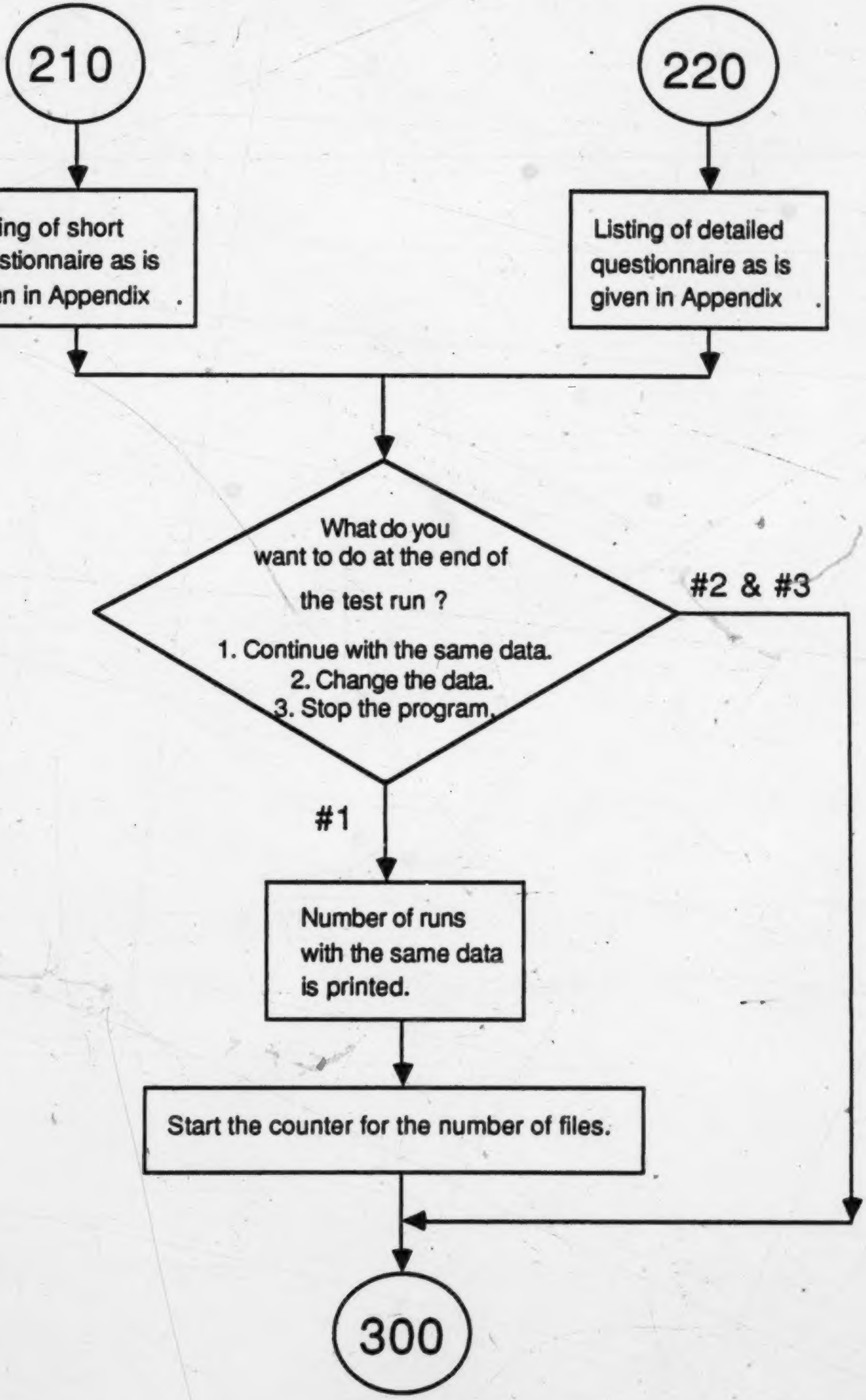
All the programs have been copyrighted.
To use these programs in whole or part requires
the approval of the author.

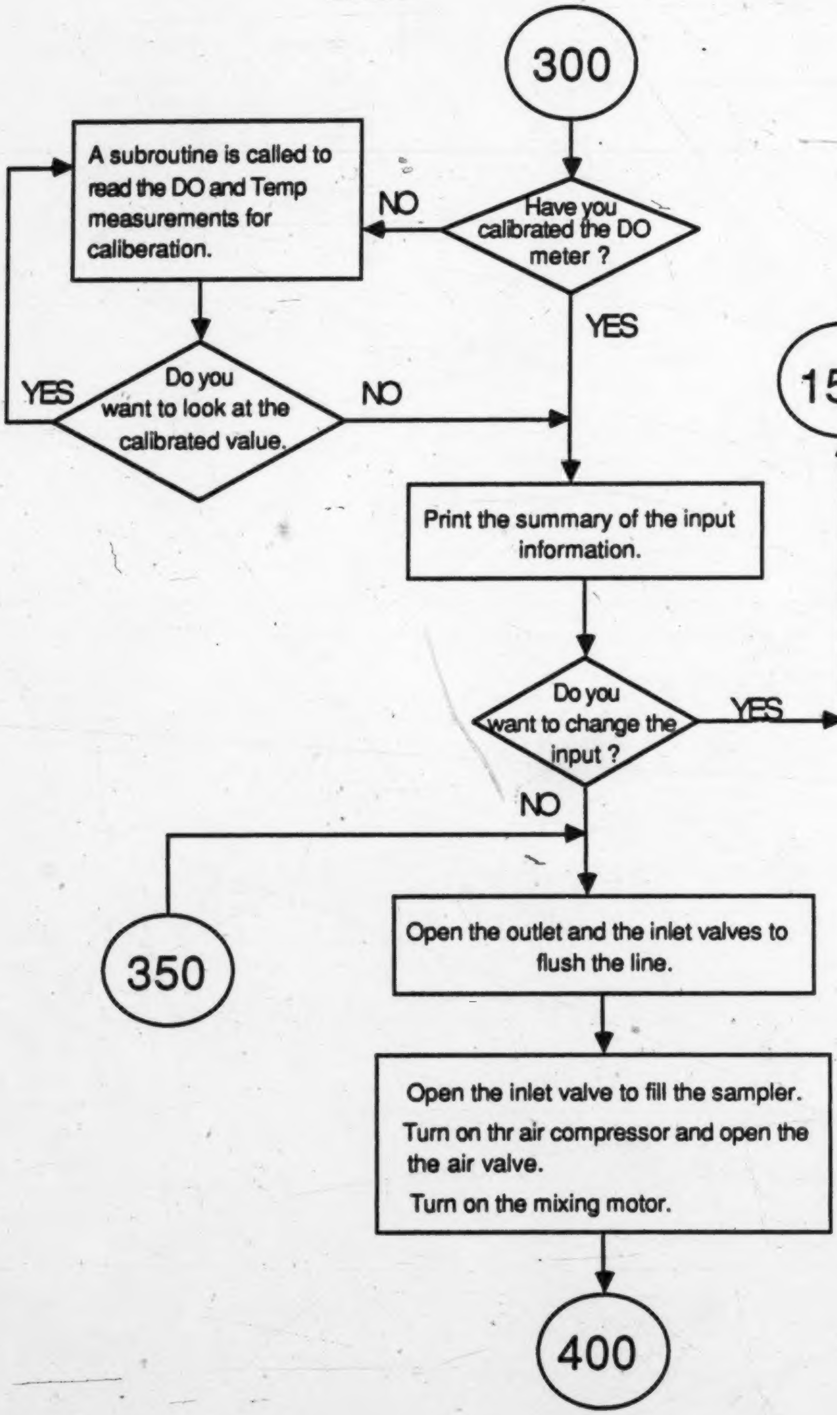
Section B1.

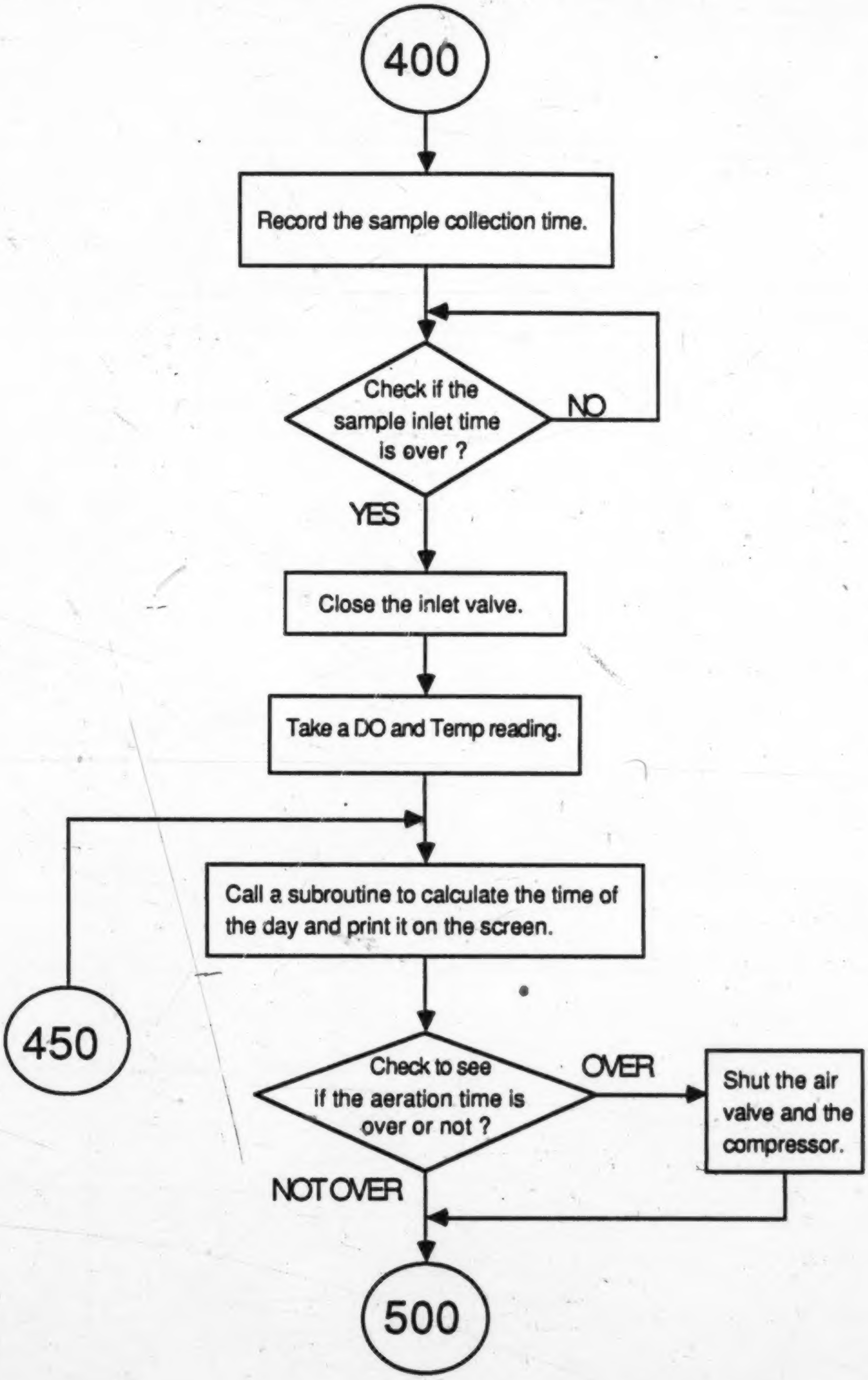
Flowchart of The "OUR.OPERATION" Program

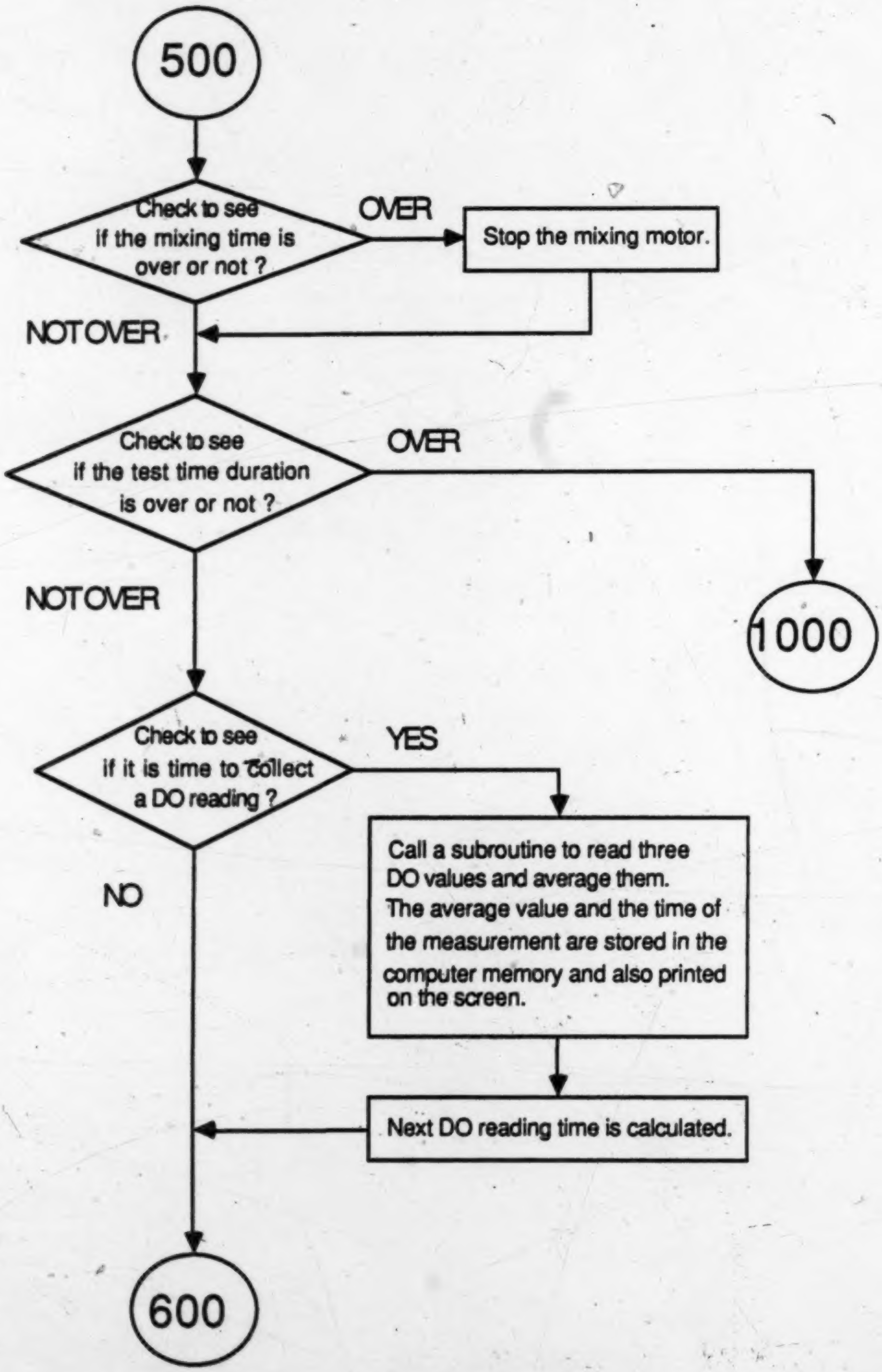

START
Initialization of the;
Dissolved Oxygen and Temperature Monitoring Unit
and, the Dissolved Oxygen Chamber Unit.
Initialize the date and time of the day
by registering it into the memory.
Will the
required information
be given on the screen or read
from a data file ?
READ FROM
A DATA FILE.
Collect information
from a given data file
(NOT DEVELOPED !!)
ON THE SCREEN.
100
END

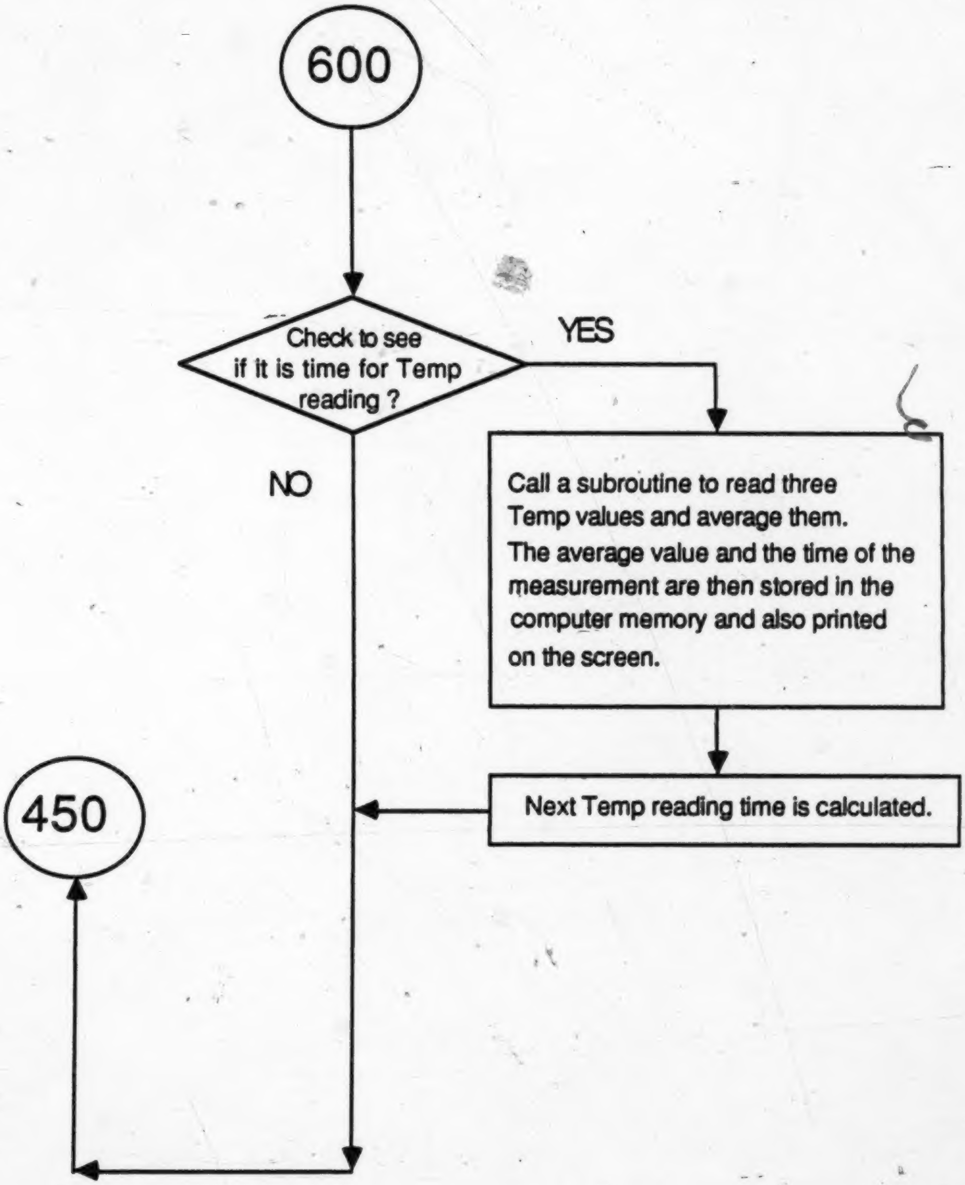

100
Input one line of comment, which will register with the data file for future reference.
Do you want to calibrate the DO meter ?
YES
NO
A subroutine is called to read the DO and Temp measurements to be calibrated.
Do you want to look at the calibrated values ?
YES
NO
Do you want the data input questions in short or in detail ?
SHORT
DETAILE
Print a summary of the operation procedure.
210
220

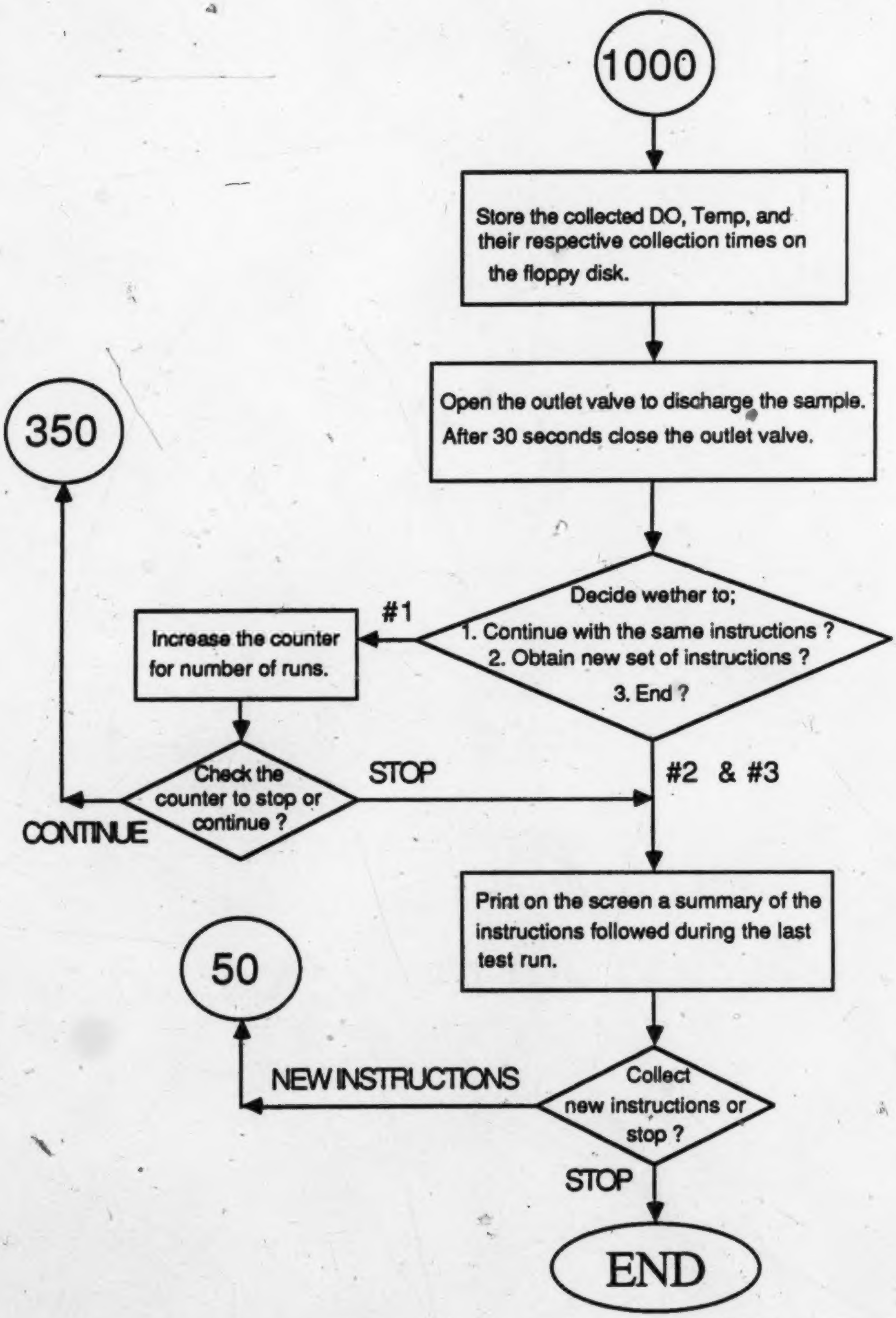

210
220
Listing of short questionnaire as is given in Appendix .
Listing of detailed questionnaire as is given in Appendix .
What do you want to do at the end of the test run ?
1. Continue with the same data.
2. Change the data.
3. Stop the program.
#2 & #3
#1
Number of runs with the same data is printed.
Start the counter for the number of files.
300


300
A subroutine is called to read the DO and Temp measurements for caliberation.
NO
Have you calibrated the DO meter ?
YES
YES
Do you want to look at the calibrated value.
NO
150
Print the summary of the input information.
Do you want to change the input ?
YES
NO
350
Open the outlet and the inlet valves to flush the line.
Open the inlet valve to fill the sampler.
Turn on thr air compressor and open the the air valve.
Turn on the mixing motor.
400


400
Record the sample collection time.
Check if the sample inlet time is over ?
NO
YES
Close the inlet valve.
Take a DO and Temp reading.
Call a subroutine to calculate the time of the day and print it on the screen.
450
Check to see if the aeration time is over or not ?
OVER
Shut the air valve and the compressor.
NOTOVER
500


500
Check to see if the mixing time is over or not ?
OVER
Stop the mixing motor.
NOTOVER
Check to see if the test time duration is over or not ?
OVER
1000
NOTOVER
Check to see if it is time to collect a DO reading ?
YES
Call a subroutine to read three DO values and average them. The average value and the time of the measurement are stored in the computer memory and also printed on the screen.
NO
Next DO reading time is calculated.
600


600
Check to see if it is time for Temp reading ?
YES
NO
Call a subroutine to read three Temp values and average them. The average value and the time of the measurement are then stored in the computer memory and also printed on the screen.
Next Temp reading time is calculated.
450


1000
Store the collected DO, Temp, and their respective collection times on the floppy disk.
Open the outlet valve to discharge the sample. After 30 seconds close the outlet valve.
Decide wether to;
1. Continue with the same instructions ?
2. Obtain new set of instructions ?
3. End ?
#1
Increase the counter for number of runs.
Check the counter to stop or continue ?
STOP
#2 & #3
CONTINUE
350
Print on the screen a summary of the instructions followed during the last test run.
50
NEW INSTRUCTIONS
Collect new instructions or stop ?
STOP
END

Listing of The "OUR.OPERATION" Program

```
10 REM********************************
20 REM
30 REM     THE PROGRAM TO OPERATE THE
40 REM   OXYGEN UPTAKE RATE DEVICE.
50 REM   MEASURES AND RECORDS THE DO
60 REM   AND TEMPERATURE OF AN
70 REM   ACTIVATED SLUDGE SAMPLE.
80 REM   THE COLLECTED DATA IS THEN
90 REM   STORED.
100 REM
110 REM   PROGRAM BY: BIJAN AIDUN.
120 REM   DATE       : JAN 9 1985
130 REM
140 REM********************************
150 REM
160 REM+++++++++SET UP VIA+++++++++++
170 REM
180 DIM DR$(200):DIM TR(100)
190 REM DDRA SET TO $F0 1=OUT 0=IN
200 POKE36867,240:POKE36866,255:POKE36864,0
210 REM DRA SET ALL OUTPUTS TO 0
220 POKE36865,0
230 REM PCR SET CA1,CA2,CB2,$CD
240 POKE36876,205
250 REM IER SET IRQ FLAG ON CA1CLOSE$82
260 POKE36878,130
270 REM
280 REM+++ GO TO START OF THE PROGRAM. +++
290 REM
300 GOTO 63999
310 REM
320 REM********************************
330 REM
340 REM     ALL THE SUBROUTINES IN THE
350 REM   PROGRAM ARE STORED HERE AT
360 REM   THE BEGINNING TO SPEED UP THE
370 REM   OPERATION PROCESS.
380 REM      LINE#300   OPEN CIRCUT
390 REM      LINE#350   CLOSE CIRCUT
400 REM      LINE#400    READ DO & TEMP
410 REM      LINE#700    STOR DO & TEMP
420 REM
430 REM
440 REM
450 REM********************************
460 P=PEEK(36864)
470 P1=P AND XC
480 IF P1=1 THEN RETURN
490 P=P+XC:POKE36864,P
500 RETURN
510 P=PEEK(36864)
520 P1=P AND XC
530 IF P1=0 THEN RETURN
540 P=P-XC:POKE36864,P
550 RETURN
560 REM
570 REM**SET CA2 HI $CF
580 POKE 36876,(205+MC)
590 FOR WA=0 TO 1500 :NEXT WA
```

```
600 BOD=0:BET=0
610 FOR A=1 TO 3
620 POKE36876,(207+MC)
630 REM**SET CA2 LO $CD
640 POKE36876,(205+MC)
650 REM**CHECK FOR CON.COMPLETE CC
660 FOR X=0 TO 150:NEXT X
670 REM**LOAD IN DATA
680 POKE36865,00
690 DO=(PEEK(36865)AND15):POKE36865,32
700 D1=(PEEK(36865)AND15):POKE36865,64
710 D2=(PEEK(36865)AND15):POKE36865,96
720 D3=(PEEK(36865)AND15)
730 AOD=(D3*1000)+(D2*100)+(D1*10)+D0
740 BOD=BOD+AOD
750 NEXT A
760 VOD=BOD/3
770 D3=INT(VOD/1000)
780 D2=INT((VOD-(D3*1000))/100)
790 D1=INT((VOD-((D3*1000)+(D2*100)))/10)
800 D0=INT((VOD-((D3*1000)+(D2*100)+(D1*10))))
810 REM
820 REM+++++ PRINT THE RECORDED DATA.+++++
830 REM
840 IF MC=0 GOTO 950
850 T=(INT((TI/3600)*100))/100
860 PRINT"▒▓▓▓                                                    "
870 PRINT"▒▓▓▓TIME;(MIN)";T;"▶▓▓D.O  ";D3;D2;".";D1;D0
880 D3$=STR$(D3):D2$=STR$(D2):D1$=STR$(D1):D0$=STR$(D0)
890 D$=D3$+D2$+"."+D1$+D0$
900 DX=DX+1
910 T$=STR$(INT(TI/60))
920 DR$(DX)=T$+D$
930 REM TO CONTINUE
940 RETURN
950 DT=D3+(D2*.1)+(D1*.01)+(D0*.001)
960 DT=DT/0.8
970 TD=(INT(((DT/0.0429)-5)*10))/10 :TD$=STR$(TD)
980 T=(INT((TI/3600)*100))/100
990 PRINT"▒                                       "
1000 PRINT"▒TIME;(MIN)";T;"  TEMPERATURE  ";TD$;"  C  "
1010 D3$=STR$(D3):D2$=STR$(D2):D1$=STR$(D1):D0$=STR$(D0)
1020 TD$=D3$+D2$+D1$+D0$
1030 TX=TX+1
1040 T$=STR$(INT(TI/60))
1050 TR$(TX)=T$+TD$
1060 REM TO CONTINUE
1070 RETURN
1080 REM
1090 REM+++++++ STORE DO & TEMP +++++++
1100 REM
1110 REM TO CONTINUE
1120 REM TO CONTINUE
1130 DX=DX+1:DR$(DX)="999"
1140 FOR ZX=0TODX:PRINT#5,DR$(ZX):NEXTZX
1150 DX=0:RETURN
1160 REM TO CONTINUE
1170 REM TO CONTINUE
1180 TX=TX+1:TR$(TX)="999"
1190 FORZX=0 TOTX:PRINT#5,TR$(ZX):NEXTZX
1200 CLOSE 5,8,5:TX=0:RETURN
```

```
1210 REM*********************************************************************
1220 REM
1230 REM     OPERATION PROGRAM
1240 REM
1250 REM*********************************************************************
1260 HMS=VAL(HMS$)+VAL(TI$)
1270 HMS$=STR$(HMS):HXMS$=RIGHT$(HMS$,6):H$=LEFT$(HXMS$,2):H=VAL(H$)
1280 S$=RIGHT$(HMS$,2):S=VAL(S$):MS$=RIGHT$(HMS$,4)
1290 M=(VAL(LEFT$(MS$,2)))
1300 IF S>59 THEN M=M+1:S=S-60
1310 IF M>59 THEN H=H+1:M=M-60
1320 IF H>23 THEN DMY=VAL(DMY$)+10000:DMY$=STR$(DMY):H=H-24
1330 HMS=(H*10000)+(M*100)+S+1000000
1340 HMS$=STR$(HMS)
1350 TI$="000000"
1360 PRINT"♥"
1370 PRINT"QQQQQQQQQ▶▶▶▶▶▶▶▶▶▶TEST RUN # ";WZ
1380 NT=0:ND=0
1390 POKE 36864,0
1400 XC=16:GOSUB 460
1410 XC=1:GOSUB 460
1420 XC=32:GOSUB 460
1430 REM
1440 REM+++ OPEN UP OUTLET VALVE TO LET OUT OLD SAMPLE
1450 REM
1460 FOR BB=1 TO 5000:NEXT BB
1470 XC=16:GOSUB 510
1480 REM++++START THE AIR VALVE & THE COMPROSSER
1490 XC=2 :GOSUB 460:XC=4 :GOSUB 460
1500 XC=8:GOSUB 460
1510 REM
1520 REM+++ STORAGE OF INFO TO THE DATA FILE
1530 REM
1540 HMS=VAL(HMS$)+VAL(TI$)
1550 HYMS$=STR$(HMS):HXMS$=RIGHT$(HYMS$,6):H$=LEFT$(HXMS$,2):H=VAL(H$)
1560 S$=RIGHT$(HXMS$,2):S=VAL(S$):MS$=RIGHT$(HXMS$,4)
1570 M=(VAL(MS$)-VAL(S$))/100
1580 IF S>59 THEN M=M+1:S=S-60
1590 IF M>59 THEN H=H+1:M=M-60
1600 IF H>23 THEN DMY=VAL(DMY$)+10000:DMY$=STR$(DMY):H=H-24
1610 HMS=(H*10000)+(M*100)+S+1000000
1620 HPMS$=STR$(HMS):DMYP$=DMY$
1630 GOTO 1800
1640 IF WZ=XD+1  THEN DD$="1"
1650 IF WZ=(XD+141) THEN DD$="0"
1660 IF WZ=(XD+281) THEN DD$="1"
1670 IF WZ=(XD+421) THEN DD$="0"
1680 IF WZ=(XD+561) THEN DD$="1"
1690 IF WZ=(XD+701) THEN DD$="0"
1700 IF WZ=(XD+841) THEN DD$="1"
1710 IF WZ=(XD+981) THEN DD$="0"
1720 IF WZ=(XD+1121) THEN DD$="1"
1730 OPEN 5,8,5,DD$+":"+HF$+",S,W"
1740 PRINT#5,DMYP$:PRINT#5,HPMS$:PRINT#5,TT$:PRINT#5,AT$:PRINT#5,MT$
1750 PRINT#5,DR$:PRINT#5,TEMPI$:PRINT#5,COM$
1760 RETURN
1770 REM
1780 REM++++++SHUT DOWN ALL THE CIRCUITS++++++++
1790 REM
1800 IF INT(TI/60)<IPT GOTO 1800
1810 XC=1:GOSUB 510
1820 XC=32:GOSUB 510
```

```
1830 REM
1840 REM+++++START THE DO READING+++++++++
1850 REM+++++STOP AERATION & MIXING++
1860 REM
1870 REM
1880 PRINT"▒"
1890 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒TEST RUN # ";WZ
1900 HMS=VAL(HMS$)+VAL(TI$)
1910 HMS$=STR$(HMS):HXMS$=RIGHT$(HMS$,6):H$=LEFT$(HXMS$,2):H=VAL(H$)
1920 S$=RIGHT$(HMS$,2):S=VAL(S$):MS$=RIGHT$(HMS$,4)
1930 M=(VAL(MS$)-VAL(S$))/100
1940 IF S>60 THEN M=M+1:S=S-60
1950 IF M>60 THEN H=H+1:M=M-60
1960 IF H>23 THEN DMY=VAL(DMY$)+10000:DMY$=STR$(DMY):H=H-24
1970 HMS=(H*10000)+(M*100)+S+1000000
1980 HMS$=STR$(HMS)
1990 TI$="000000"
2000 MC=32:GOSUB 570
2010 MC=0 :GOSUB 570
2020 DD=DR
2030 TM=TEMPI
2040 H1MS$=HMS$
2050 HMS=VAL(H1MS$)+VAL(TI$)
2060 H2MS$=STR$(HMS):HXMS$=RIGHT$(H2MS$,6):H$=LEFT$(HXMS$,2):H=VAL(H$)
2070 S$=RIGHT$(H2MS$,2):S=VAL(S$):MS$=RIGHT$(H2MS$,4)
2080 M=(VAL(MS$)-VAL(S$))/100
2090 IF S>59 THEN M=M+1:S=S-60
2100 IF M>59 THEN H=H+1:M=M-60
2110 IF H>23 THEN H=H-24
2120 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒TIME OF DAY. ";H;"▌:";M;"▌ ";S;"▌    "
2130 REM
2140 IF INT(TI/60)=>AT THENXC=2:GOSUB510:XC=4: GOSUB 510
2150 REM++++SHUT OFF THE AIR VALVE & THE COMPRESSOR
2160 IF INT(TI/60)=>MT THENXC=8:GOSUB510
2170 IF INT(TI/60)=>TT THEN GOSUB 1640 :GOSUB1090:GOSUB1160:GOTO2340
2180 IF INT(TI/60)=>DD THEN GOSUB 2210
2190 IF INT(TI/60)=>TM THEN GOSUB 2250
2200 GOTO 2050
2210 IF MC=32THEN GOSUB 600:GOTO 2230
2220 MC=32:GOSUB 570
2230 DD=DD+DR
2240 RETURN
2250 IF MC=0 THEN GOSUB 600:GOTO 2270
2260 MC=0:GOSUB 570
2270 TM=TM+TEMPI
2280 RETURN
2290 REM
2300 REM++++++DISCHARGE OF++++++++++++
2310 REM+++SAMPLE AFTER TESTING++++++++
2320 REM
2330 REM
2340 XC=16:GOSUB 460
2350 IF NPS=1 GOTO 2410
2360 IF NPS=2 THEN GOSUB 2380:GOSUB 2490:GOTO2690
2370 IF NPS=3 THEN GOSUB 2380:GOSUB 2490:END
2380 FOR OU=1 TO 6500:NEXT OU
2390 POKE 36864,0
2400 RETURN
2410 REM
2420 IF WZ=WX THEN GOSUB 2380:GOSUB 2490:GOTO 2890
2430 WZ=WZ+1
2440 WZ$=STR$(WZ)
2450 NF$=NOF$+WZ$
2460 POKE 36864,16
2470 FOR OU=1 TO 6500:NEXT OU
2480 GOTO 1260
```

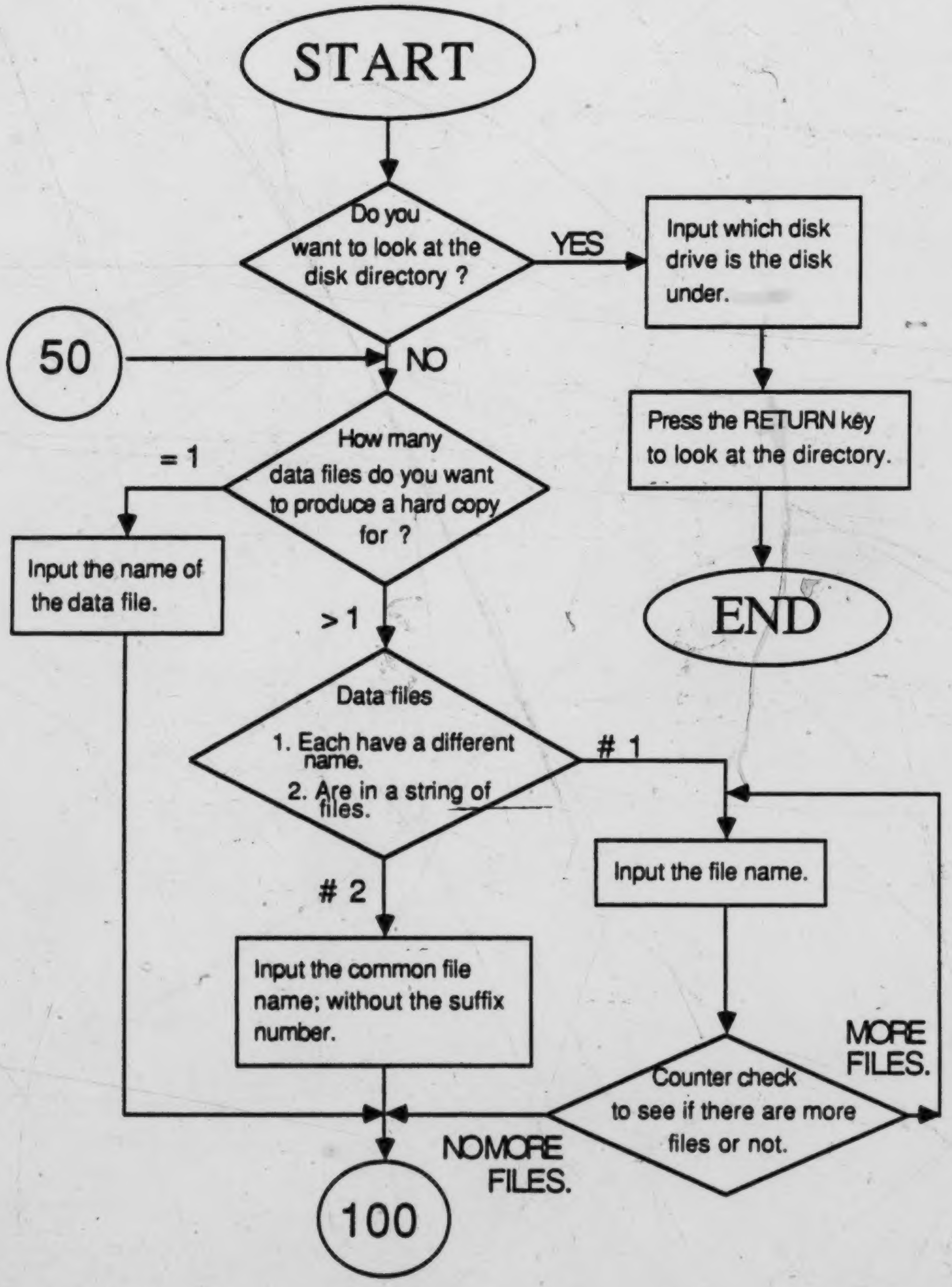
```
2490 REM
2500 REM+++++ PRINTOUT OF THE SUMMARY +++++
2510 REM
2520 PRINT"]████THIS IS THE END OF TEST RUN"
2530 PRINT"███TOTAL TEST TIME WAS"TAB(32)(TT/60)TAB(37)"MIN"
2540 PRINT"███D.O READINGS COLLECTED EVERY"TAB(32)DRTAB(37)"SEC"
2550 PRINT"███TEMP READINGS COLLECTED EVERY"TAB(32)TEMPITAB(37)"SEC"
2560 IF WX<1 GOTO 2610
2570 PRINT"██**THERE WERE TOTAL OF ";WZ;" RUNS MADE"
2580 PRINT"███DATA WERE STORED UNDER "
2590 PRINT"██FILE NAME,";NOF$;" 1,THROUGH,";WZ
2600 WZ=0:GOTO 2620
2610 PRINT"███DATA WERE STORED UNDER FILE; ";NF$
2620 PRINT"███ON THE DISK DRIVE #";DD$
2630 PRINT"████TO GET THE PRINTOUT OF DATA "
2640 PRINT"███USE BA.PRINTOUT PROGRAM AND"
2650 PRINT"███ENTER THE NAME OF FILE."
2660 PRINT"████TO START THE RUN TYPE IN 'S'"
2670 GETKY$:IF KY$="S" GOTO 2690
2680 GOTO 2670
2690 RETURN
2700 REM*********************************************************************
2710 REM
2720 REM
2730 REM  GET THE INFO FOR THE PROGRAM
2740 REM
2750 REM
2760 REM*********************************************************************
2770 PRINT"]████WHAT IS THE DATE TODAY?"
2780 PRINT"█GIVE THE INFORMATION AS DAY/MONTH/YEAR."
2790 INPUT"█IE. 9/JAN/85 AS 090185 ,";DMY$
2800 PRINT"███TIME OF THE DAY IN 24-HR CLOCK ?"
2810 INPUT"█IE. FOR 1:45 PM, 134500, ";HMS$
2820 TI$=HMS$:DMY=VAL(DMY$):DMY=DMY+1000000:DMY$=STR$(DMY)
2830 HMS$="1000000"
2840 PRINT"]████WILL THE REQUIRED INFORMATION BE GIVEN"
2850 INPUT"█ ON THE SCREEN OR DATA FILE";INFO$
2860 IF ASC(INFO$)=68 GOTO 2840
2870 IF ASC(INFO$)=83 GOTO 2890
2880 INPUT"*****ERROR TYPE IN SCREEN OR DATA FILE";INFO$:GOTO 2860
2890 INPUT"████ANY COMMENTS FOR FUTURE REFERENCE";COM$
2900 PRINT"]████DO YOU WANT TO CALIBRATE"
2910 INPUT"█FOR D.O AND TEMP";CAL$
2920 IF ASC(CAL$)=78 GOTO 3000
2930 IF ASC(CAL$)<>89 GOTO 2900
2940 MC=0: GOSUB 3620
2950 MC=32:GOSUB 3620
2960 PRINT"]████DO YOU WANT TO LOOK "
2970 INPUT"█AT THE CALIBRATED VALUE";H$
2980 IF ASC(H$)=89 GOTO 2940
2990 IF ASC(H$)<>78 GOTO 2960
3000 PRINT"]████DO YOU WANT"
3010 INPUT"█THE QUESTIONS IN SHORT OR DETAIL";Q$
3020 IF ASC(Q$)=83 GOTO 4170
3030 IF ASC(Q$)=68 GOTO 3050
3040 GOTO 3000
3050 PRINT"]████NOTE:"
3060 PRINT"███ACTIVATED SLUDGE WILL AUTOMATICALLY "
3070 PRINT"BE PUMPED INTO THE SAMPLER.THE AERATION"
3080 PRINT"AND MIXING OF THE SAMPLE WILL ALSO"
3090 PRINT"START AUTOMATICALLY AND CONTINUE"
3100 PRINT"AS LONG AS REQUIRED."
3110 PRINT"████D.O AND TEMP READINGS WILL START"
3120 PRINT"AS SOON AS THE SAMPLER IS FULL."
3130 PRINT"THESE DATA ARE STORED AS LONG"
3140 PRINT"AND AS OFTEN AS REQUIRED"
3150 GET KY$:IF KY$="" GOTO3150
```

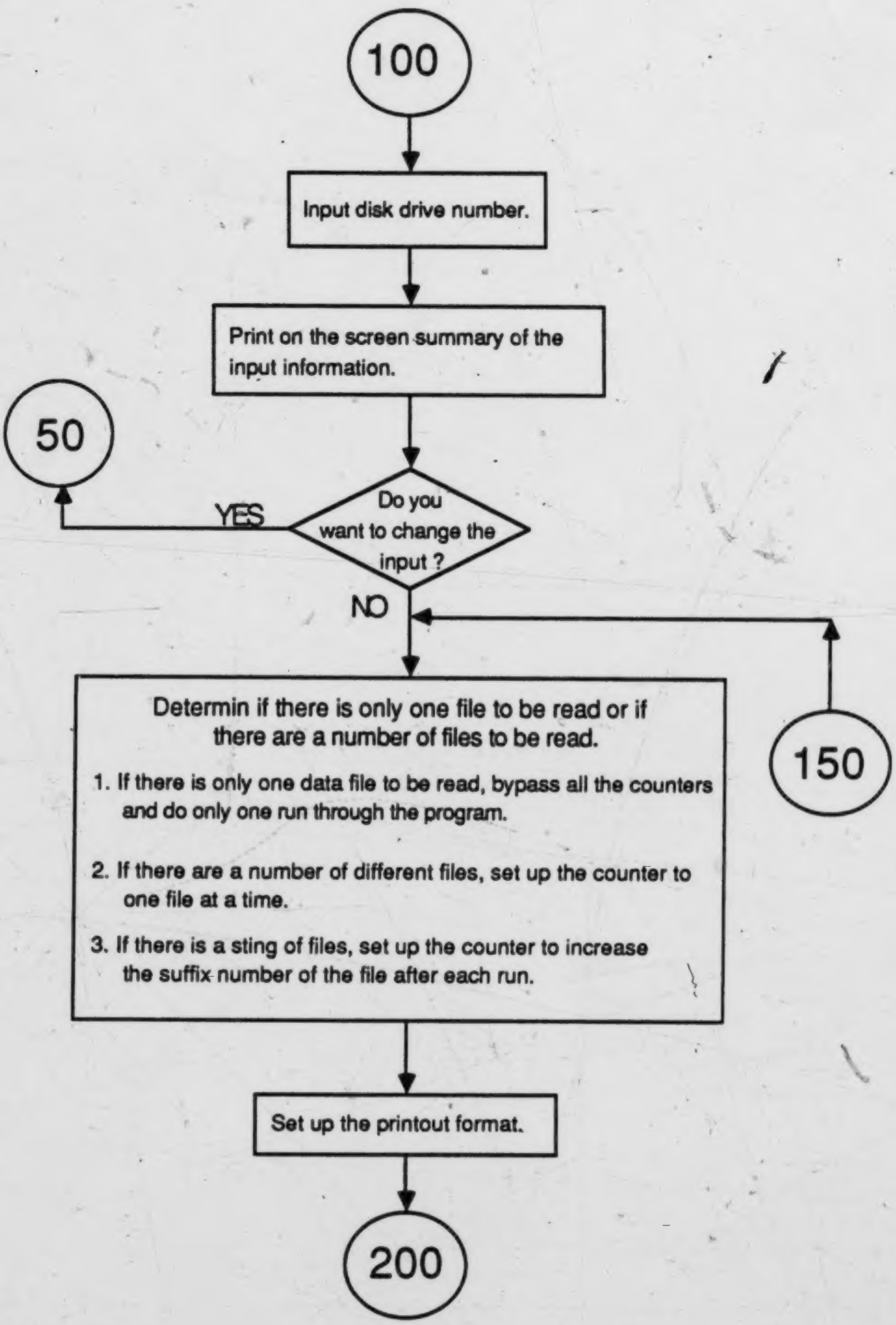
```
3160 PRINT"HOW MANY MINUTES WILL IT"
3170 INPUT"TAKE TO FILL THE SAMPLER";IPT
3180 PRINT"HOW MANY MINUTES DO YOU WANT"
3190 INPUT"TO AERATE THE SAMPLE";AT
3200 PRINT"HOW MANY MINUTES DO YOU WANT"
3210 INPUT"TO MONITOR (TOTAL TEST TIME)";TT
3220 PRINT"HOW MANY MINUTES DO YOU"
3230 INPUT"WANT TO MIX THE SAMPLE";MT
3240 PRINT"HOW FREQUENTLY IN SECONDS"
3250 INPUT"DO YOU WANT D.O READINGS";DR
3260 PRINT"HOW FREQUENTLY IN SECONDS"
3270 INPUT"DO YOU WANT TEMPERATURE READINGS";TEMPI
3280 PRINT"UNDER WHAT FILE NAME DO YOU"
3290 INPUT"WANT THE DATA STORED ";NF$
3300 PRINT"WHAT DO YOU WANT TO DO THE NEXT RUN?"
3310 PRINT"1.) CONTINUE WITH THE SAME DATA"
3320 PRINT"2.) CHANGE THE DATA."
3330 PRINT"3.) STOP THE PROGRAM."
3340 INPUT"TYPE IN THE APPROPRIATE NUMBER";NPS
3350 IF NPS<>1 GOTO 3430
3360 PRINT"HOW MANY TIMES SHOULD THE"
3370 INPUT"TEST BE RUN WITH THE SAME DATA";WX
3380 PRINT"THE DATA FILE WILL BE"
3390 PRINT"NAMED,";NF$" 1,THROUGH,";NF$;WX
3400 NOF$=NF$
3410 NF$=NFF$+" 1"
3420 GET KY$:IF KY$="" GOTO 3420
3430 IF NPS>3 GOTO 3340
3440 IF NPS=2 THEN WZ=WZ+1:WX=0: GOTO 3460
3450 WZ=1
3460 PRINT"NOTE FOR CONTINOUS RUN, FIRST DISK"
3470 PRINT"HAS TO BE IN DRIVE #0"
3480 PRINT"HOW MANY  DATA FILES"
3490 INPUT"DO YOU WANT STORED ON THIS DISK";XD
3500 PRINT"WHICH DISK DRIVE IS "
3510 INPUT"THE DATA DISK UNDER";DD$
3520 PRINT"HAVE YOU CALIBRATED THE D.O METER"
3530 INPUT"FOR TEMPERATURE AND PRESSURE";YN$
3540 IF ASC(YN$)=89 GOTO 3920
3550 IF ASC(YN$)<>78 THEN INPUT"TYPE IN YES OR NO";YN$:GOTO3540
3560 MC=0:GOSUB 3620
3570 MC=32:GOSUB 3620
3580 PRINT"DO YOU WANT TO LOOK AT TEMP."
3590 INPUT "AND CALIBRATED D.O";FF$
3600 IF FF$="Y" GOTO 3560
3610 GOTO 3920
3620 PRINT"DATA TO CALIBRATE THE D.O METER."
3630 PRINT"                              "
3640 BOD=0
3650 FOR A=1 TO 3
3660 POKE36876,(207+MC)
3670 POKE36876,(205+MC)
3680 FORX=0TO150:NEXTX
3690 POKE36865,00
3700 D0=(PEEK(36865)AND15):POKE36865,32
3710 D1=(PEEK(36865)AND15):POKE36865,64
3720 D2=(PEEK(36865)AND15):POKE36865,96
3730 D3=(PEEK(36865)AND15)
3740 AOD=(D3*1000)+(D2*100)+(D1*10)+D0
3750 BOD=BOD+AOD
3760 NEXT A
3770 VOD=BOD/3
3780 D3=INT(VOD/1000)
3790 D2=INT((VOD-(D3*1000))/100)
```

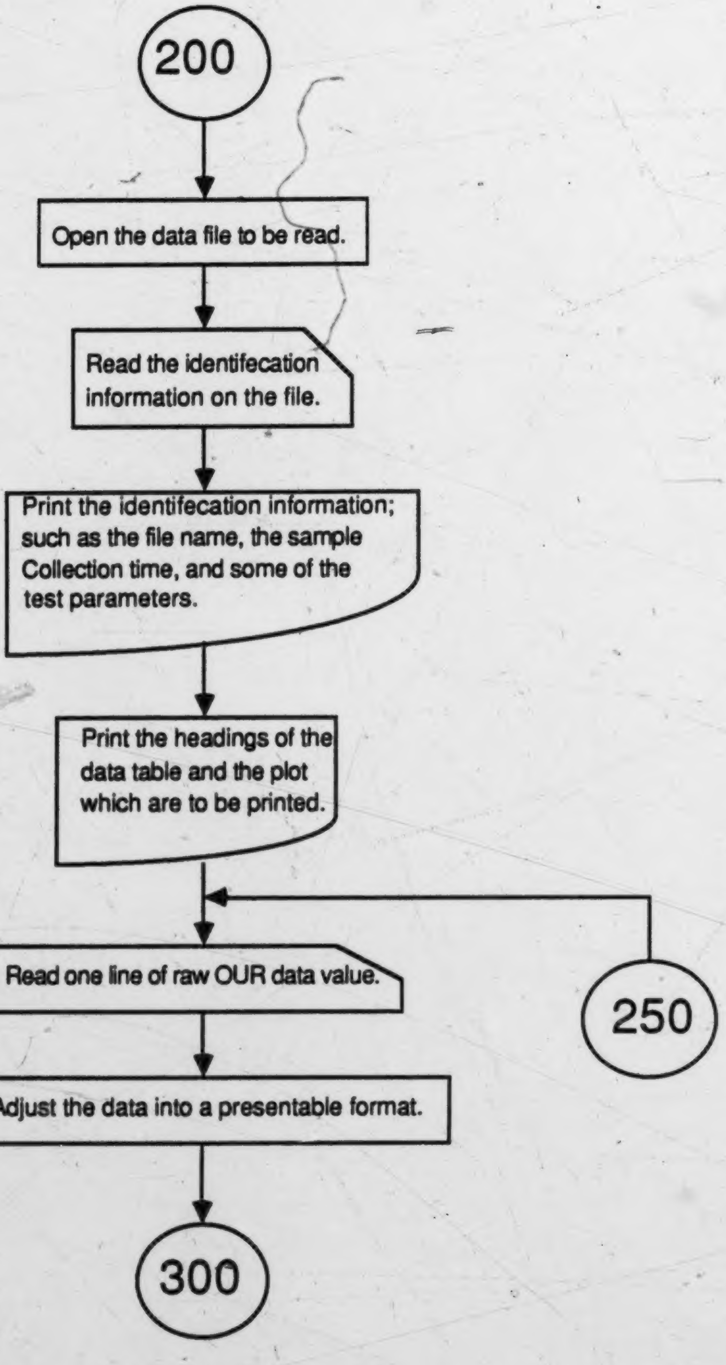
```
3800 D1=INT((VOD-((D3*1000)+(D2*100)))/10)
3810 D0=INT((VOD-((D3*1000)+(D2*100)+(D1*10))))
3820 IF MC=0 GOTO 3860
3830 PRINT"D.O";D3;D2;".";D1;D0
3840 GET KY$:IFKY$=""GOTO 3640
3850 RETURN
3860 DT=D3+(D2*.1)+(D1*.01)+(D0*.001)
3870 DT=DT/0.8
3880 TD=(INT(((DT/0.0429)-5)*10))/10 :TD$=STR$(TD)
3890 PRINT"TEMP";TD$;"  C   "
3900 GET KY$:IF KY$="" GOTO3640
3910 RETURN
3920 PRINT"SUMMARY OF INPUT INFORMATION:"
3930 PRINT"TIME TO FILL THE SAMPLER:"TAB(28)IPTTAB(35)"MIN"
3940 PRINT"AERAATION TIME:"TAB(28)ATTAB(35)"MIN"
3950 PRINT"MIXING TIME:"TAB(28)MTTAB(35)"MIN"
3960 PRINT"MONITORING TIME:"TAB(28)TTTAB(35)"MIN"
3970 PRINT"D.O READING EVERY:"TAB(28)DRTAB(35)"SEC"
3980 PRINT"TEMP READING EVERY:"TAB(28)TEMPITAB(35)"SEC"
3990 PRINT"DATA STORED UNDER FILE. ";NF$
4000 PRINT"DISK DRIVE #";DD$;"  WILL BE USED."
4010 PRINT"***D.O METER HAS BEEN CALIBRATED***"
4020 PRINT"DO YOU WANT TO":INPUT"CHANGE THE INPUT DATA Y/N";NY$
4030 IF ASC(NY$)=89 GOTO 3160
4040 IF ASC(NY$)<>78 THEN INPUT"TYPE IN YES OR NO";NY$:GOTO 4030
4050 PRINT"THE OPERATION HAS STARTED."
4060 IPT$=STR$(IPT)
4070 IPT=IPT*60
4080 AT$=STR$(AT)
4090 AT=(AT*60)
4100 MT$=STR$(MT)
4110 MT=(MT*60)
4120 TT$=STR$(TT)
4130 TT=(TT*60)
4140 DR$=STR$(DR)
4150 TEMPI$=STR$(TEMPI)
4160 GOTO 1260
4170 INPUT"TIME TO FILL SAMPLE;  MIN";IPT
4180 INPUT"AERATION TIME;         MIN";AT
4190 INPUT"TOTAL TEST TIME;       MIN";TT
4200 INPUT"MIXING TIME;           MIN";MT
4210 INPUT"D.O READINGS EVERY;    SEC";DR
4220 INPUT"TEMP READINGS ENERY;   SEC";TEMPI
4230 GOTO 3280
```

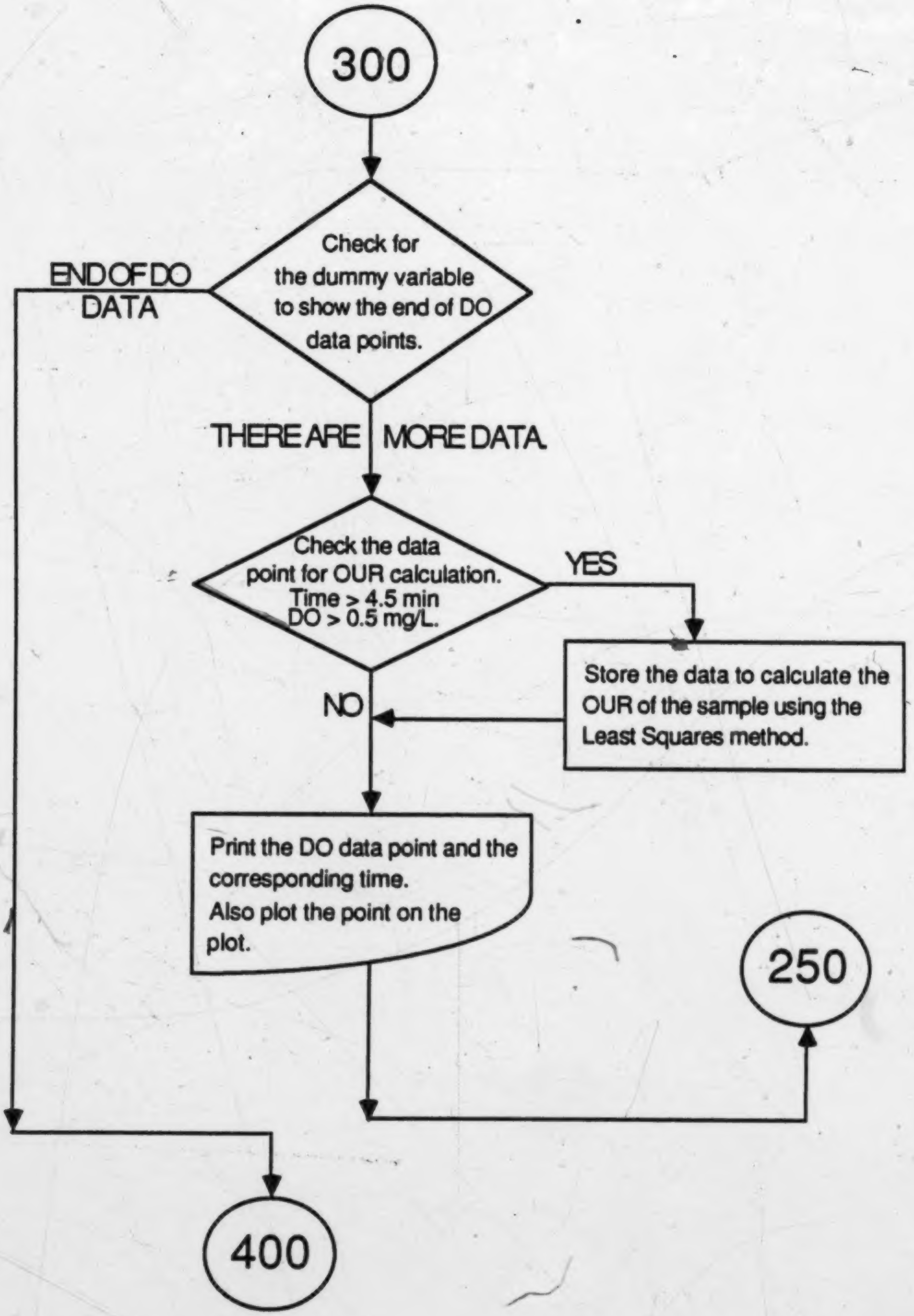
Section B2.

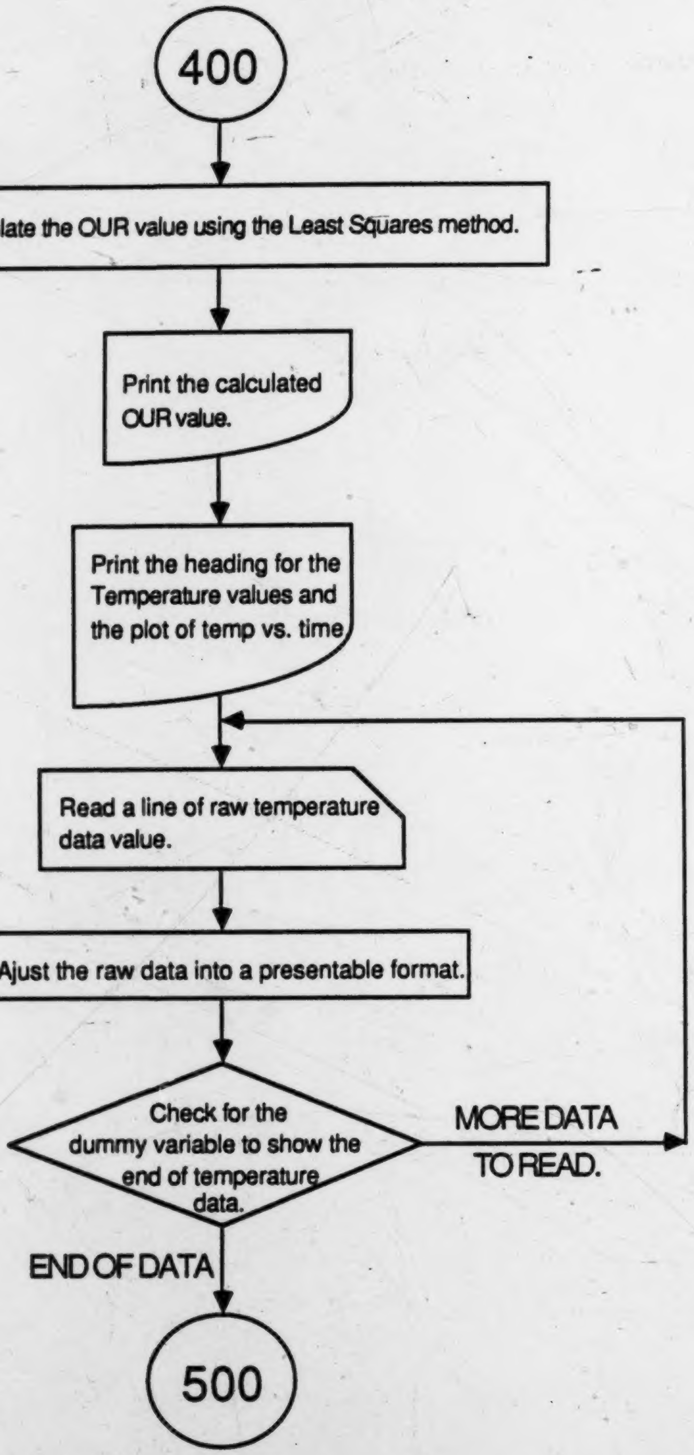
Flowchart of The "BA.PRINTOUT" Program

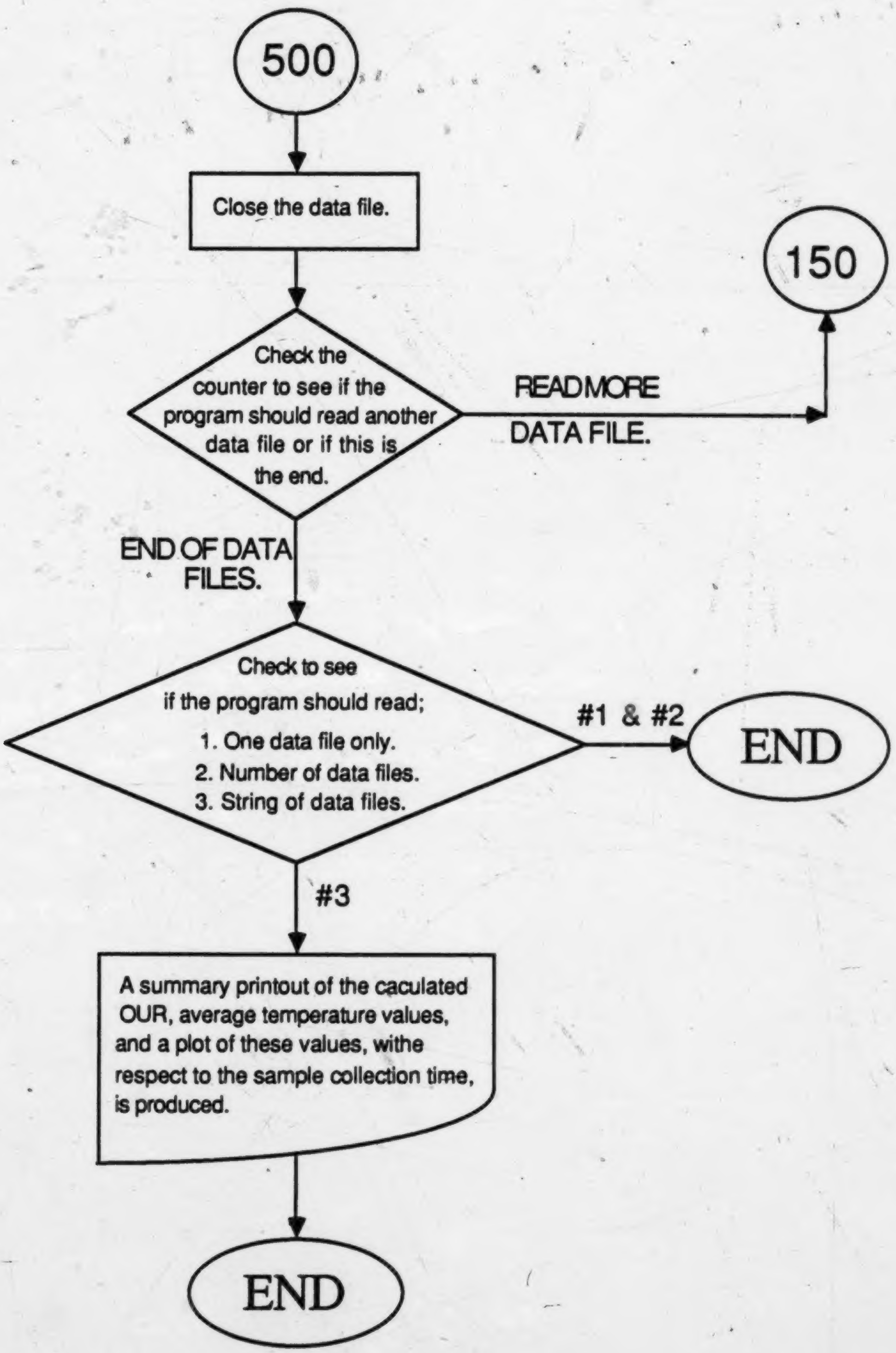

START
Do you want to look at the disk directory ?
YES
Input which disk drive is the disk under.
Press the RETURN key to look at the directory.
END
50
NO
How many data files do you want to produce a hard copy for ?
= 1
Input the name of the data file.
> 1
Data files
1. Each have a different name.
2. Are in a string of files.
# 1
Input the file name.
# 2
Input the common file name; without the suffix number.
Counter check to see if there are more files or not.
MORE FILES.
NOMORE FILES.
100


100
Input disk drive number.
Print on the screen summary of the input information.
50
YES
Do you want to change the input ?
NO
Determin if there is only one file to be read or if there are a number of files to be read.
1. If there is only one data file to be read, bypass all the counters and do only one run through the program.
2. If there are a number of different files, set up the counter to one file at a time.
3. If there is a sting of files, set up the counter to increase the suffix number of the file after each run.
150
Set up the printout format.
200


200
Open the data file to be read.
Read the identifecation information on the file.
Print the identifecation information; such as the file name, the sample Collection time, and some of the test parameters.
Print the headings of the data table and the plot which are to be printed.
Read one line of raw OUR data value.
250
Adjust the data into a presentable format.
300


300
Check for the dummy variable to show the end of DO data points.
END OF DO DATA
THERE ARE MORE DATA.
Check the data point for OUR calculation. Time > 4.5 min DO > 0.5 mg/L.
YES
Store the data to calculate the OUR of the sample using the Least Squares method.
NO
Print the DO data point and the corresponding time. Also plot the point on the plot.
250
400


400
Calculate the OUR value using the Least Squares method.
Print the calculated OUR value.
Print the heading for the Temperature values and the plot of temp vs. time
Read a line of raw temperature data value.
Ajust the raw data into a presentable format.
Check for the dummy variable to show the end of temperature data.
MORE DATA TO READ.
END OF DATA
500


500
Close the data file.
150
Check the counter to see if the program should read another data file or if this is the end.
READ MORE DATA FILE.
END OF DATA FILES.
Check to see if the program should read;
1. One data file only.
2. Number of data files.
3. String of data files.
#1 & #2
END
#3
A summary printout of the caculated OUR, average temperature values, and a plot of these values, withe respect to the sample collection time, is produced.
END

Listing of The "BA.PRINTOUT" Program

```
100 REM*********************************
110 REM
120 REM    PRINTOUT PROGRAM TO PRINT
130 REM  THE D.O & TEMP DATA COLLECTED.
140 REM
150 REM    PROGRAM BY: BIJAN AIDUN
160 REM    DATE --    : JAN,10,1985
170 REM*********************************
180 DIM ZNN$(200):DIM SH(200):DIM ST$(200)
190 PRINT"⊐▒▒▒▒DO YOU WANT TO LOOK AT "
200 INPUT"THE DISK DIRACTORY Y/N";YN$
210 IF ASC(YN$)=78 GOTO 370
220 IF ASC(YN$)<>89 GOTO 190
230 INPUT"▒▒WHICH DISK DRIVE #";DD$
240 PRINT"⊐▒▒▒D$"+DD$
250 PRINT"▒HIT RETURN KEY.":PRINT"▒":END
260 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒DO YOU WANT TO"
270 INPUT"GET A PRINTOUT OF YOUR FILE, OR STOP";NY$
280 IF ASC(NY$)=83THEN END
290 PRINT"⊐▒▒▒▒UNDER WHAT FILE NAME IS"
300 INPUT"THE DATA STORED ";QNN$
310 NN$=QNN$
320 PRINT"▒▒NOTE THE FIRST DISK HAS TO BE"
330 PRINT"IN DRIVE #0"
340 PRINT"▒▒HOW MANY OF THE DATA FILES"
350 INPUT"▒ARE ON THE FIRST DISK";XT
360 RETURN
370 REM CLR
380 PRINT"⊐▒▒▒▒HOW MANY CONTINUOUS RUNS"
390 INPUT"▒DO YOU WANT THE DATA FOR";NZ
400 IF NZ=1 GOTO 540
410 PRINT"▒▒▒WAS THE DATA STORED UNDER;"
420 PRINT"▒   1. DIFFERENT FILE NAMES."
430 PRINT"    2. STRING OF FILE NAMES."
440 INPUT"▒          TYPE THE APPROPIATE NUMBER;";DZ
450 IF DZ=2 THEN GOSUB 290:GOTO 570
460 IF DZ=1 GOTO 480
470 GOTO 380
480 FOR LZ=1 TO NZ
490 PRINT"⊐▒▒▒▒NAME OF DATA FILE # ";LZ
500 INPUT"⊐▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒";MM$
510 ZNN$(LZ)=MM$
520 NEXT LZ
530 NN$=ZNN$(1):GOTO 570
540 PRINT"⊐▒▒▒▒UNDER WHAT FILE NAME THE"
550 INPUT"DATA IS STORED ";NN$
560 REM
570 INPUT"▒▒WHICH DISK DRIVE IS THE DATA DISK IN";DD$
580 PRINT"⊐▒▒▒▒THE GIVEN INFORMATION IS AS SUCH"
590 PRINT"▒▒▒DATA IS STORED UNDER , ";NN$
600 PRINT"▒▒▒THE DISK IS IN DRIVE #  ";DD$
610 INPUT"▒▒DO YOU WANT TO CHANGE, Y/N";Y$
620 IF ASC(Y$)=89 THEN PRINT"⊐":GOTO 260
630 IF ASC(Y$)<>78 GOTO 610
640 REM*******************************
650 REM
660 REM     START OF PROGRAM TO
670 REM     READ & PRINTOUT DATA
680 REM*******************************
690 IF NZ=1 GOTO 860
```

```
700 QZ=0
710 FOR VX=1 TO NZ
720 IF DZ=1 GOTO 750:IF VX=(XT+1) THEN DD$="1"
730 IF VX=(XT+141) THEN DD$="0"
740 IF DZ=2 THEN GOSUB 770
750 IF DZ=1 THEN GOSUB 820
760 GOTO 860
770 QZ=QZ+1
780 QZ$=STR$(QZ)
790 NN$=QNN$+QZ$
800 RETURN
810 REM
820 QX=QX+1
830 NN$=ZNN$(QX)
840 RETURN
850 REM
860 OPEN 6,4,6:CMD 6
870 PRINT#6,CHR$(24)
880 OPEN 7,4:OPEN 15,8,15
890 OPEN 2,4,2
900 OPEN 1,4,1
910 PRINT#2,"9999"TAB(3)"999.99"TAB(4)"99.99":CLOSE2
920 PRINT#7,TAB(7)"********** THIS IS THE DATA COLLECTED ":PRINT#6,CHR$(24)
930 PRINT#7,TAB(7)"********** UNDER THE FILE NAME,",NN$
940 PRINT#7,"████████████████████████████████████████████████████████████"
950 OPEN5,8,5,DD$+":"+NN$+",S,R"
960 INPUT#5,DMY$:INPUT#5,HMS$
970 INPUT#5,TT$:INPUT#5,AT$
980 INPUT#5,MX$:INPUT#5,DR$:INPUT#5,TEMPI$:INPUT#5,COM$
990 DMY$=RIGHT$(DMY$,6):HMS$=RIGHT$(HMS$,6)
1000 D$=LEFT$(DMY$,2):MY$=RIGHT$(DMY$,4):M$=LEFT$(MY$,2):Y$=RIGHT$(DMY$,2)
1010 HR$=RIGHT$(HMS$,6):H$=LEFT$(HR$,2):MS$=RIGHT$(HMS$,4)
1020 MT$=LEFT$(MS$,2):S$=RIGHT$(HMS$,2):TEMPI$=RIGHT$(TEMPI$,3)
1030 TT$=RIGHT$(TT$,3):AT$=RIGHT$(AT$,3):MX$=RIGHT$(MX$,3):DR$=RIGHT$(DR$,3)
1040 PRINT#6,CHR$(48)
1050 PRINT#7,"COMMENT :";COM$:PRINT#7,"   "
1060 PRINT#7,TAB(12)"THIS TEST WAS CONDUCTED ON THE, ";D$;"/";M$;"/";Y$
1070 PRINT#7,TAB(12)"THE TEST STARTED AT  (HR:MIN),  ";H$;":";MT$
1080 PRINT#7,TAB(12)"TOTAL TESTING TIME WAS, (MIN)   ";TT$
1090 PRINT#7,TAB(12)"SAMPLE WAS AERATED FOR, (MIN)   ";AT$
1100 PRINT#7,TAB(12)"SAMPLE WAS MIXED FOR,   (MIN)   ";MX$
1110 PRINT#7," ":IF QZ=1 THEN D1$=D$:M1$=M$:Y1$=Y$
1120 PRINT#7,TAB(12)"D.O  READINGS WERE TAKEN EVERY (SEC)   ";DR$
1130 PRINT#7,TAB(12)"TEMP READINGS WERE TAKEN EVERY (SEC)   ";TEMPI$
1140 PRINT#7," "
1150 PRINT#6,CHR$(50)
1160 PRINT"ℷ"
1170 PRINT#7,TAB(5)"TIME"TAB(9)"D.O"
1180 PRINTTAB(8)"TIME"TAB(25)"D.O"
1190 PRINT#7,TAB(2)"SEC"TAB(4)"MIN"TAB(6)"MG/L"
1200 PRINT#6,CHR$(1)
1210 PRINT#7,TAB(24)"0"TAB(4)"1"TAB(4)"2"TAB(4)"3"TAB(4)"4"TAB(4)"5"TAB(4)"6"
1220 PRINT#7,TAB(59)"7"TAB(4)"8"TAB(4)"9"TAB(3)"10"TAB(3)"11"
1230 PRINT#6,CHR$(24)
1240 PRINTTAB(4)"SEC"TAB(12)"MIN"TAB(24)"MG/L"
1250 PRINT"    "
1260 PRINT#7,TAB(24)"+———+———+———+———+———+D.O+——MG/L——+———+———+———+"
1270 PRINT#6,CHR$(1)
1280 PRINT#7,"████████████████████████"
1290 PRINT#6,CHR$(24)
1300 DX=0:INPUT#5,DOM$
1310 DX=DX+1:DX$=STR$(DX)
1320 INPUT#15,EN$,EM$:IF EN$<>"00" GOTO1540
1330 FOR ZX=1 TO 100
1340 INPUT#5,TDO$
1350 IF LEN(TDO$)<7 GOTO 1540
1360 LN=LEN(TDO$)
```

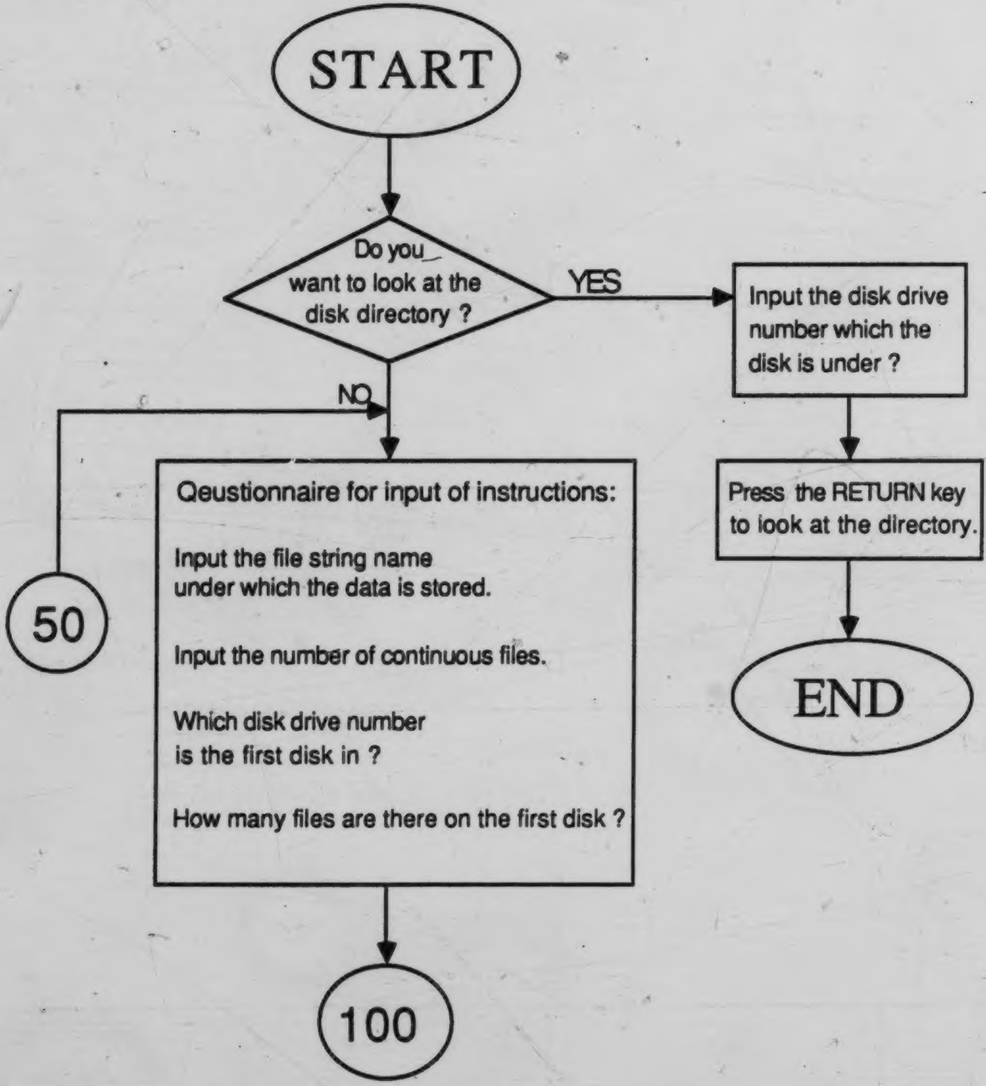
```
1370 LN=LN-8
1380 T$=LEFT$(TDO$,LN)
1390 DO$=RIGHT$(TDO$,8)
1400 TW$=RIGHT$(T$,LN-2):TS=VAL(TW$)
1410 T=(INT((VAL(TW$)/60)*100))/100
1420 OD=VAL(DO$)
1430 WO=INT(OD*5)+24
1440 PRINT#1,TS,T,OD
1450 PRINT#6,CHR$(1)
1460 IF ZX=10 THEN S1X=TS:S3Y=OD:PRINT#7,TAB(WO+1)"●"
1470 IF ZX=26 THEN S2X=TS:S4Y=OD:PRINT#7,TAB(WO+1)"●"
1480 PRINT#7,TAB(24)"|"TAB(WO-24)"+"
1490 PRINT#6,CHR$(24)
1500 PRINTTAB(4)TSTAB(13)TTAB(23)OD
1510 NEXT ZX
1520 REM TO CONT
1530 GOTO 1310
1540 REM TO CONT
1550 PRINT#7,"                                         "
1560 PRINT"                                         "
1570 SLOPE=(S3Y-S4Y)/(S2X-S1X)
1580 XM=(INT(SLOPE*60000))/1000
1590 XH=(XM*60)
1600 PRINT#7,"█████████████████ OUR =";XM;"MG/L.MIN";"▬▬▬▬▬▬▬";XH;"MG/L.HR"
1610 PRINT#7,"                                        "
1620 PRINT"                                         "
1630 PRINT#7,"                                        "
1640 PRINT"                                          "
1650 PRINT#7,TAB(5)"TIME"TAB(9)"TEMP"
1660 PRINTTAB(8)"TIME"TAB(25)"TEMP"
1670 PRINT#7,TAB(2)"SEC"TAB(4)"MIN"TAB(7)"C"
1680 PRINT#6,CHR$(1)
1690 PRINT#7,TAB(24)"10"TAB(3)"12"TAB(3)"14"TAB(3)"16"TAB(3)"18"TAB(3)"20"
1700 PRINT#7,TAB(54)"22"TAB(3)"24"TAB(3)"26"TAB(3)"28"TAB(3)"30"TAB(2)"32"
1710 PRINT#6,CHR$(24)
1720 PRINTTAB(4)"SEC"TAB(13)"MIN"TAB(26)"C"
1730 PRINT"                              "
1740 PRINT#7,TAB(24)"┼────┼────┼────┼────┼────┼────┼TEMP┼─C──┼────┼────┼────┼"
1750 PRINT#6,CHR$(1)
1760 PRINT#7,"━━━━━━━━━━━━━━━━━━━━━"
1770 PRINT#6,CHR$(24)
1780 TX=0:INPUT#5,DOM$
1790 FOR ZX=1 TO 50
1800 INPUT#15,EN$,EM$:IFEN$<>"00"GOTO1990
1810 INPUT#5,TTE$
1820 IF LEN(TTE$)<8 GOTO 1990
1830 LN=LEN(TTE$)
1840 LN=LN-7
1850 T$=LEFT$(TTE$,LN)
1860 TE$=RIGHT$(TTE$,7)
1870 TW$=RIGHT$(T$,LN-2):TS=VAL(TW$)
1880 T=(INT((VAL(TW$)/60)*100))/100
1890 TE=(INT((((VAL(TE$)/800)/0.0429)-5)*10))/10
1900 WO=INT((TE-10)*2.5)+24
1910 PRINT#1,TS,T,TE
1920 PRINT#6,CHR$(1)
1930 PRINT#7,TAB(24)"|"TAB(WO-24)"O"
1940 PRINT#6,CHR$(24)
1950 PRINTTAB(4)TSTAB(13)TTAB(24)TE
1960 NEXT ZX
1970 CLOSE5,8,5
1980 GOTO 2010
1990 CLOSE5,8,5
2000 PRINT"                              "
2010 PRINT#7,"                              "
2020 PRINT#6,CHR$(0)
2030 PRINT#7,TAB(15)"*******************  END OF DATA  *************"
2040 PRINT#6,CHR$(24)
2050 PRINT#7,TAB(15)"*******************  FOR THE FILE; ";NN$
```

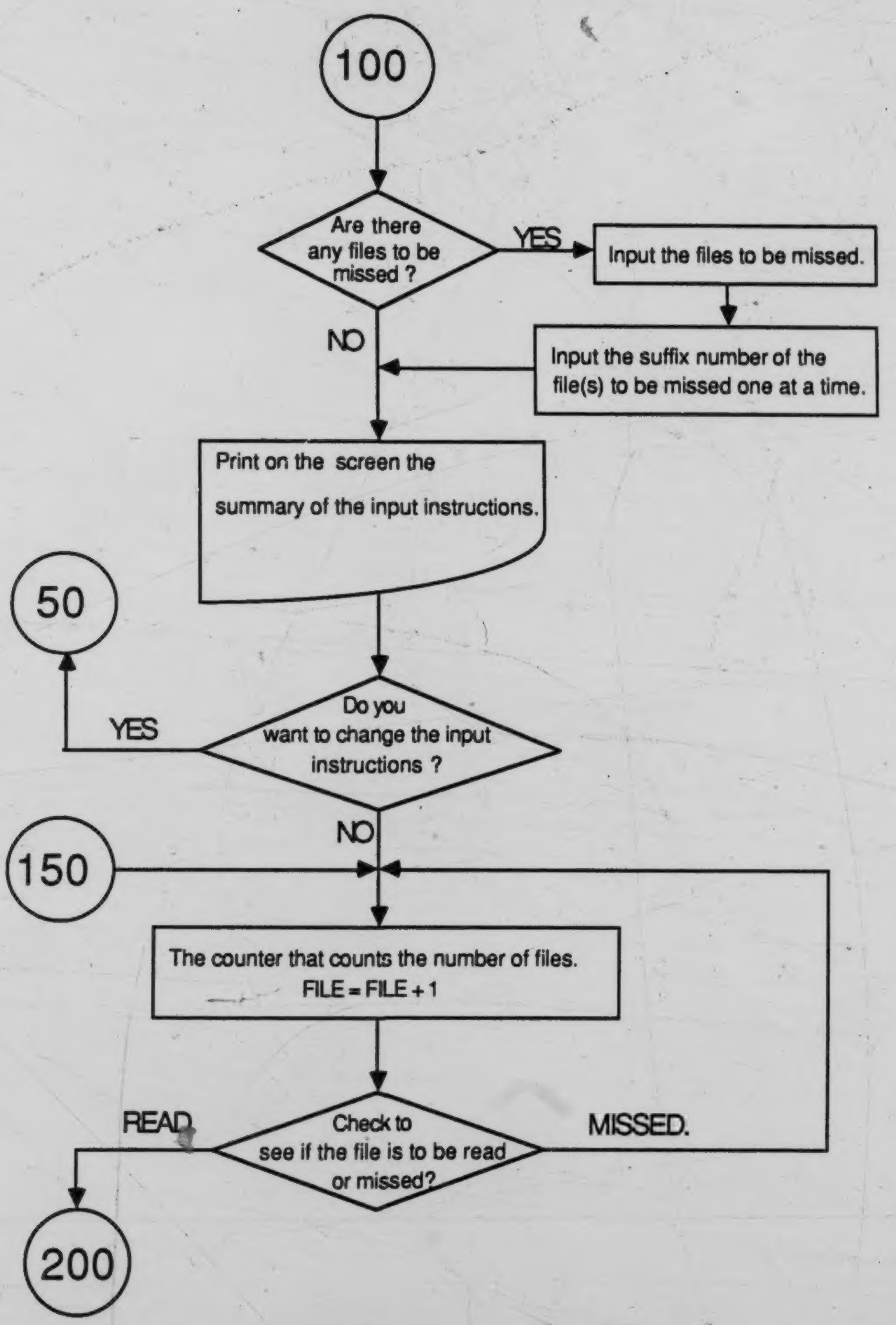
```
2060 PRINT#7,"   "
2070 CLOSE 15,8,15
2080 PRINT"********** END OF DATA ********"
2090 PRINT"******* FOR FILE;";NN$
2100 PRINT#6,CHR$(0)
2110 FOR R=1 TO 3
2120 PRINT#7,"                                "
2130 NEXT R
2140 PRINT#6,CHR$(24)
2150 CLOSE 7,4
2160 CLOSE 2,4,2
2170 CLOSE 1,4,1
2180 CLOSE 6,4,6
2190 IF NZ=1 THEN END
2200 SH(VX)=XH
2210 ST$(VX)=H$+":"+MT$
2220 NEXT VX
2230 IF DZ=1 THEN END
2240 OPEN 7,4
2250 OPEN 6,4,6:CMD6
2260 PRINT#6,CHR$(48)
2270 PRINT#7,"                                                 "
2280 PRINT#7,"                                                 "
2290 PRINT#7,"                                                 "
2300 PRINT#7,"                                                 "
2310 PRINT#7,"   "
2320 PRINT#7,"   "
2330 PRINT#7,"                  SUMMARY OF THE DATA COLLECTED "
2340 PRINT#7,"             ────────────
2350 PRINT#7," "
2360 PRINT#7,"             STARTING FROM ";D1$;"/";M1$;"/";Y1$;"  AT ";ST$(1)
2370 PRINT#7,"              FROM DATA FILE  ───── ";QNN$;" 1  THROUGH  ";NZ
2380 PRINT#7,"             ──────────────────────────────────────"
2390 PRINT#7,"                                   "
2400 PRINT#7,"                                       "
2410 PRINT#7,"COMMENT";COM$
2420 PRINT#7,"                                       "
2430 PRINT#7,"                                       "
2440 PRINT#7," TIME       OUR"
2450 PRINT#7,"OF DAY    MG/L.HR"
2460 PRINT#7,TAB(20)" 17   18   19   20   21   22   23   24   25"
2470 PRINT#6,CHR$(1)
2480 PRINT#7,TAB(65)" 26   27   28   "
2490 PRINT#6,CHR$(24)
2500 PRINT#7,"──────────────────"
2510 PRINT#6,CHR$(1)
2520 PRINT#7,TAB(20)"++────+────+────+────+────+OUR+MG/L.HR──+────+────+────+"
2530 PRINT#7,TAB(75)"────"
2540 PRINT#6,CHR$(24)
2550 FOR OX=1 TO NZ
2560 W2=(SH(OX)-17)*5
2570 IF W2<0 THEN W2=0
2580 IF NZ<50 GOTO 2620
2590 NS=VAL(LEFT$(ST$(OX),2))
2600 IF NS<OS THEN GOSUB 2700
2610 OS=NS
2620 PRINT#7,ST$(OX);"     ";SH(OX)
2630 PRINT#6,CHR$(1)
2640 PRINT#7,TAB(20)"|"TAB(W2)"+"
2650 PRINT#6,CHR$(24)
2660 NEXT OX
2670 CLOSE 6
2680 CLOSE 7
2690 END
2700 PRINT#6,CHR$(24)
2710 PRINT#7,"──────────────────"
2720 PRINT#6,CHR$(1)
2730 PRINT#7,TAB(20)"++────+────+────+────+────+OUR+MG/L.HR──+────+────+────+"
2740 PRINT#7,TAB(75)"────"
2750 PRINT#6,CHR$(1)
2760 RETURN
```

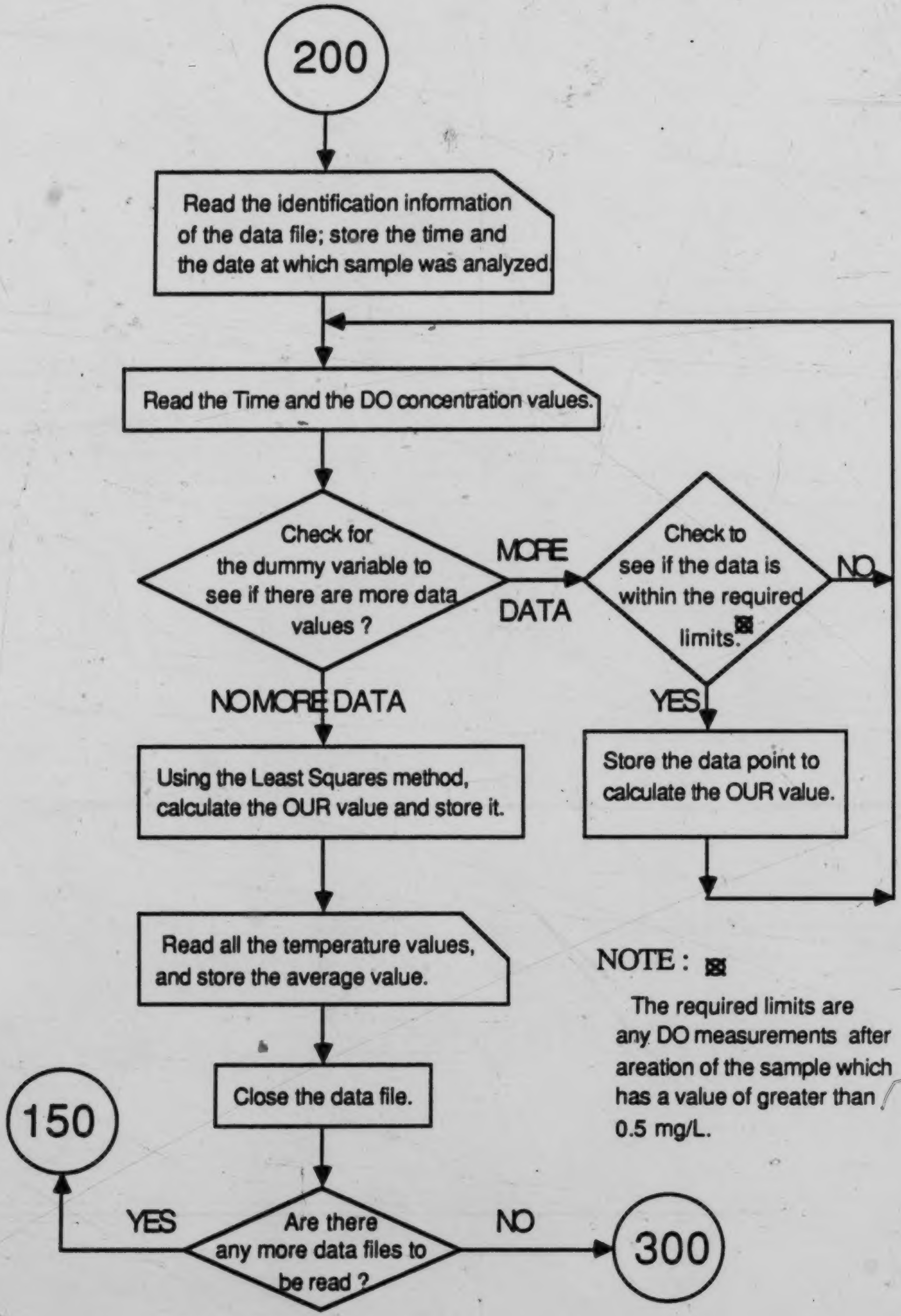
Section B3.

Flowchart of The "BA.SUMMARY" Program

(Copyright)

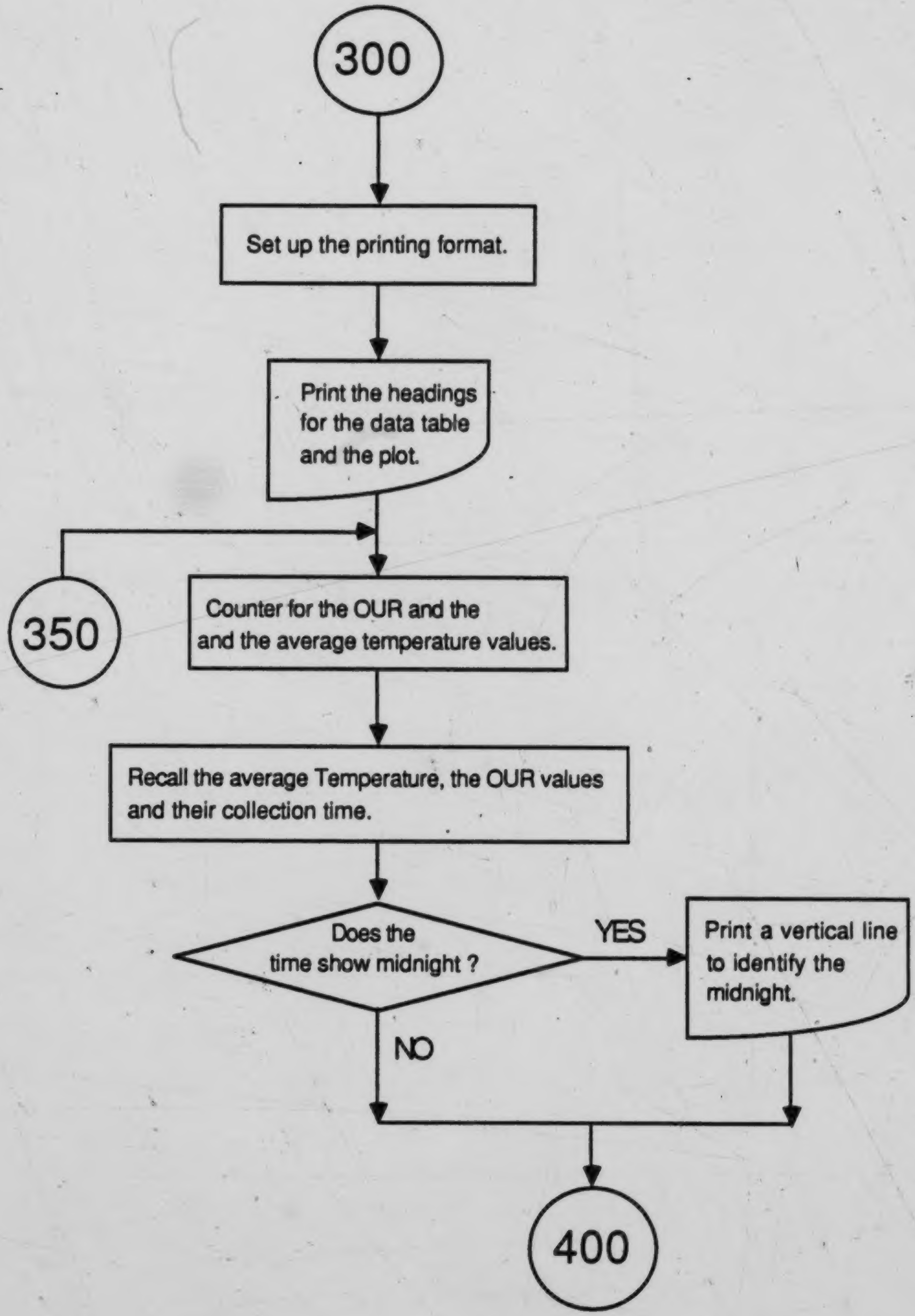

START
Do you want to look at the disk directory ?
YES
Input the disk drive number which the disk is under ?
Press the RETURN key to look at the directory.
END
NO
Qeustionnaire for input of instructions:
Input the file string name under which the data is stored.
Input the number of continuous files.
Which disk drive number is the first disk in ?
How many files are there on the first disk ?
50
100

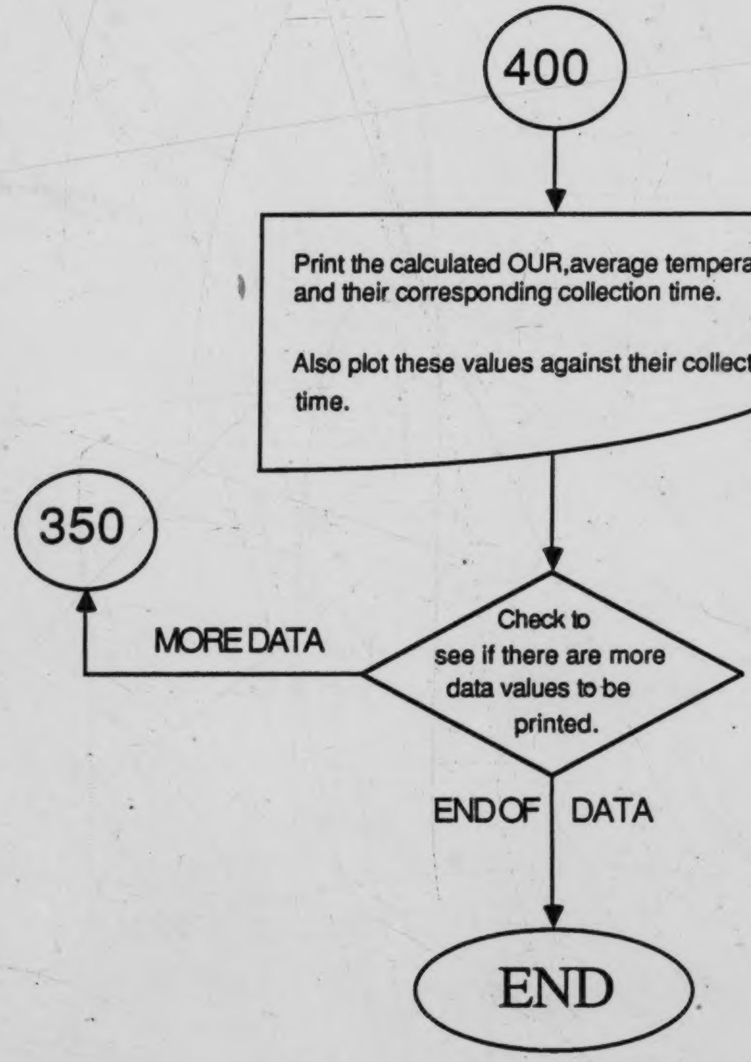

100
Are there any files to be missed ?
YES
Input the files to be missed.
NO
Input the suffix number of the file(s) to be missed one at a time.
Print on the screen the summary of the input instructions.
50
YES
Do you want to change the input instructions ?
NO
150
The counter that counts the number of files.
FILE = FILE + 1
READ
Check to see if the file is to be read or missed?
MISSED.
200


200
Read the identification information of the data file; store the time and the date at which sample was analyzed.
Read the Time and the DO concentration values.
Check for the dummy variable to see if there are more data values ?
MORE DATA
Check to see if the data is within the required limits. ⊠
NO
YES
NO MORE DATA
Using the Least Squares method, calculate the OUR value and store it.
Store the data point to calculate the OUR value.
Read all the temperature values, and store the average value.
Close the data file.
150
YES
Are there any more data files to be read ?
NO
300

NOTE : ⊠

The required limits are any DO measurements after areation of the sample which has a value of greater than 0.5 mg/L.


300
Set up the printing format.
Print the headings for the data table and the plot.
350
Counter for the OUR and the and the average temperature values.
Recall the average Temperature, the OUR values and their collection time.
Does the time show midnight ?
YES
Print a vertical line to identify the midnight.
NO
400


400
Print the calculated OUR,average temperature, and their corresponding collection time.
Also plot these values against their collection time.
350
MORE DATA
Check to see if there are more data values to be printed.
END OF DATA
END

Listing of The "BA.SUMMARY" Program

(Copyright)

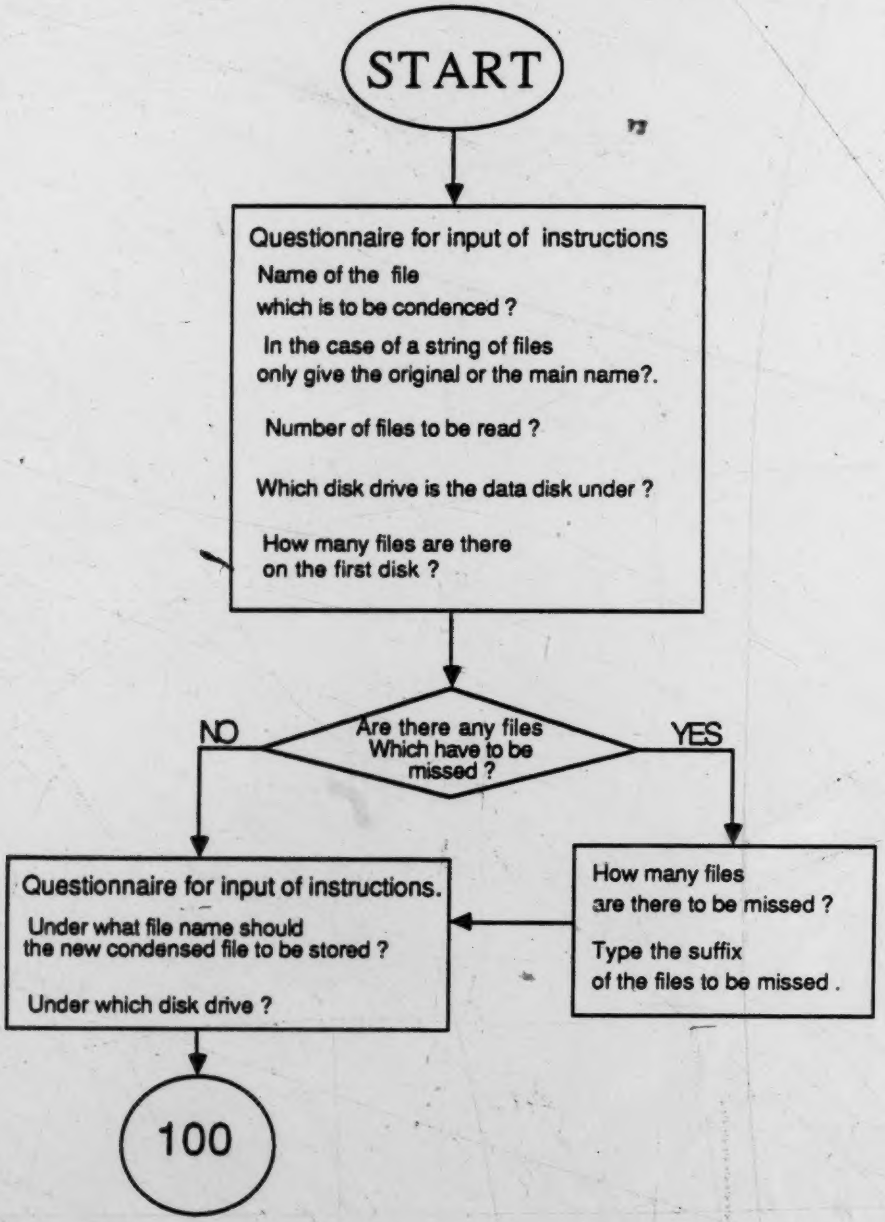
```
100 REM********************************
110 REM
120 REM    PRINTOUT PROGRAM
130 REM       TO DO A STATISTICAL ANALYSIS ON THE DATA
140 REM       CALCULATE THE OUR PER HOUR AND
150 REM       PRINTOUT THE SUMMARY OF THE RESULTS.
160 REM
170 REM    PROGRAME BY: BIJAN AIDUN
180 REM    DATE       : MAY,06,1985
190 REM*********************************
200 DIM ZNN$(600):DIM SH(600):DIM ST$(600):DIM AVT(600)
210 PRINT"]▮▮▮▮DO YOU WANT TO LOOK AT "
220 INPUT"THE DISK DIRECTORY Y/N";YN$
230 IF ASC(YN$)=78 GOTO 280
240 IF ASC(YN$)<>89 GOTO 210
250 INPUT"▮▮WHICH DISK DRIVE #";DD$
260 PRINT"]▮▮▮▮$"+DD$
270 PRINT"▮HIT RETURN KEY.":PRINT"▮":END
280 PRINT"]▮▮▮▮▮UNDER WHAT FILE STRING NAME IS"
290 INPUT"▮THE DATA STORED ";QNN$
300 NN$=QNN$
310 PRINT"]▮▮▮▮▮HOW MANY CONTINUOUS RUNS"
320 INPUT"▮DO YOU WANT THE DATA FOR";NZ
330 INPUT"▮▮WHICH DISK DRIVE IS THE DATA DISK IN";DD$
340 PRINT"▮▮▮NOTE THE FIRST DISK"
350 PRINT"HAS TO BE UNDER DRIVE #0"
360 PRINT"▮▮▮HOW MANY FILES ARE"
370 INPUT"▮THERE ON THE FIRST DISK";XT
380 PRINT"]▮▮▮▮▮THE GIVEN INFORMATION IS AS SUCH"
390 PRINT"▮**DATA IS STORED UNDER , ";NN$
400 PRINT"▮**THERE WILL BE ";NZ;" DATA FILES READ"
410 PRINT"▮**THE DISK IS IN DRIVE #  ";DD$
420 PRINT"▮**THERE ARE ";XT;" FILES ON THE FIRST DISK"
430 INPUT"▮▮DO YOU WANT TO CHANGE, Y/N";Y$
440 IF ASC(Y$)=89 THEN PRINT"]":GOTO 280
450 IF ASC(Y$)<>78 GOTO 430
460 REM********************************
470 REM
480 REM     START OF PROGRAM TO
490 REM     READ & PRINTOUT DATA
500 REM********************************
510 FOR VX=1 TO NZ
520 IF VX=(XT+1)   THEN DD$="1"
530 IF VX=(XT+141) THEN DD$="0"
540 IF VX=(XT+281) THEN DD$="1"
550 IF VX=(XT+421) THEN DD$="0"
560 IF VX=(XT+561) THEN DD$="1"
570 IF VX=(XT+701) THEN DD$="0"
580 IF VX=(XT+841) THEN DD$="1"
590 QZ=QZ+1
600 QZ$=STR$(QZ)
610 NN$=QNN$+QZ$
620 OPEN 15,8,15
630 OPEN 5,8,5,DD$+":"+NN$+",S,R"
640 INPUT#5,DMY$:INPUT#5,HMS$
650 INPUT#5,TT$:INPUT#5,AT$
660 INPUT#5,MX$:INPUT#5,DR$:INPUT#5,TEMPI$:INPUT#5,COM$
670 DMY$=RIGHT$(DMY$,6)
680 D$=LEFT$(DMY$,2):MY$=RIGHT$(DMY$,4):M$=LEFT$(MY$,2):Y$=RIGHT$(DMY$,2)
690 HR$=RIGHT$(HMS$,6):H$=LEFT$(HR$,2):MS$=RIGHT$(HMS$,4)
700 MT$=LEFT$(MS$,2):S$=RIGHT$(HMS$,2):TEMPI$=RIGHT$(TEMPI$,3)
710 TT$=RIGHT$(TT$,3):AT$=RIGHT$(AT$,3):MX$=RIGHT$(MX$,3):DR$=RIGHT$(DR$,3)
```

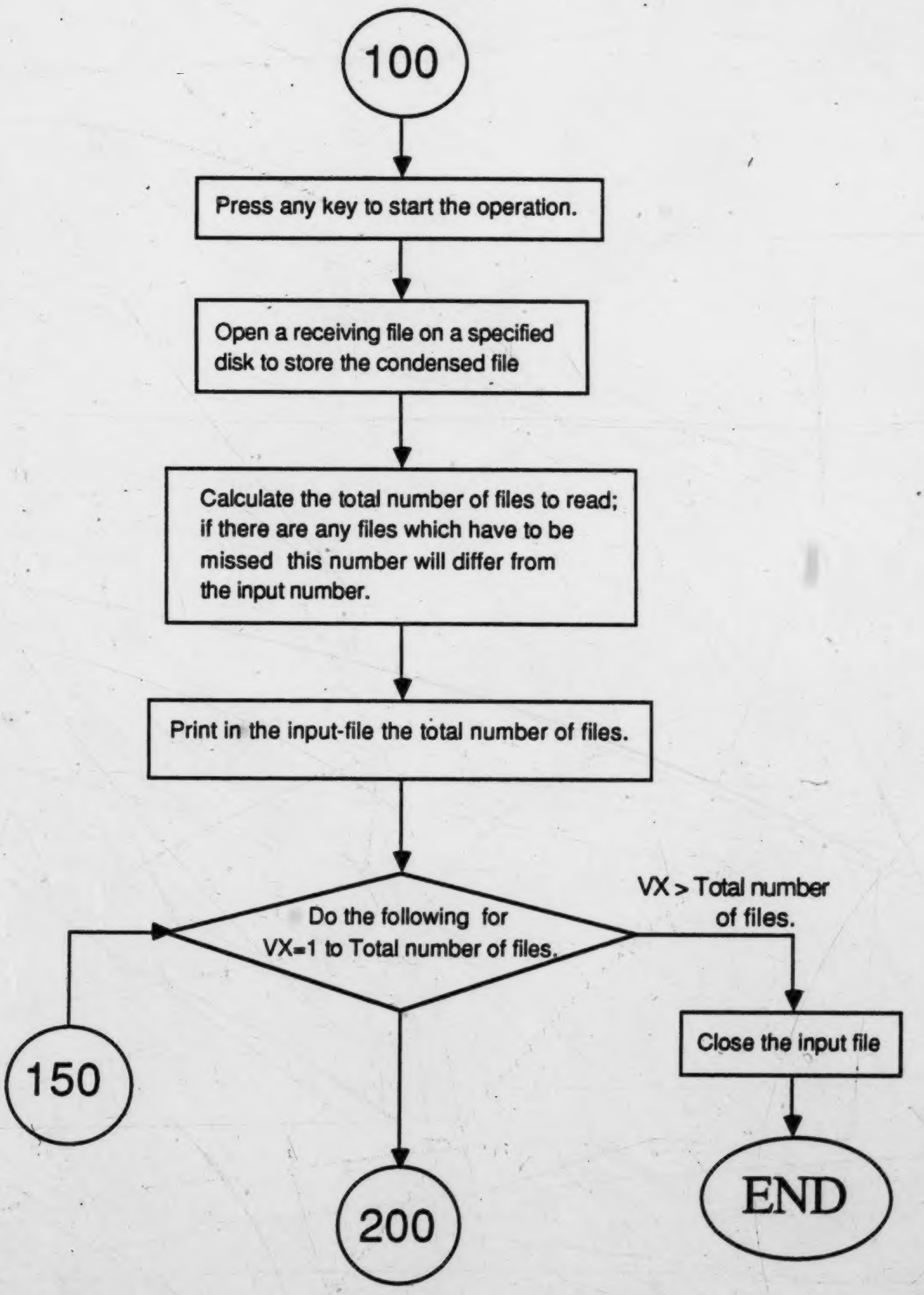
```
720 IF VX=1 THEN D1$=D$:M1$=M$:Y1$=Y$
730 DX=0:INPUT#5,DOM$
740 DX=DX+1:DX$=STR$(DX)
750 REM TO CONT
760 PRINT"READING FILE",NN$
770 INPUT#15,EN$,EM$:IF EN$<>"00" GOTO990
780 OD=0:TS=0:CU=0:CX=0:CY=0:SX=0:NP=0
790 FOR ZX=1 TO 100
800 INPUT#5,TDO$
810 IF LEN(TDO$)<7 GOTO 970
820 LN=LEN(TDO$)
830 LN=LN-8
840 T$=LEFT$(TDO$,LN)
850 DO$=RIGHT$(TDO$,8)
860 TW$=RIGHT$(T$,LN-2):TS=VAL(TW$)
870 T=(INT((VAL(TW$)/60)*100))/100
880 OD=VAL(DO$)
890 IF TS<270 THEN NEXT ZX
900 IF OD<0.50 THEN NEXT ZX
910 NP=NP+1
920 CU=(OD*TS)+CU
930 CX=(TS+CX)
940 CY=(OD+CY)
950 SX=(TS*TS)+SX
960 NEXT ZX
970 LS=((NP*CU)-(CX*CY))/((NP*SX)-(CX*CX))
980 XM=(INT(LS*60000))/1000
990 XH=XM*60*(1-2)
1000 TX=0:INPUT#5,DOM$
1010 TX=TX+1:TX$=STR$(TX)
1020 ATE=0:TE=0
1030 REM TO CONT
1040 FOR ZX=1 TO 50
1050 INPUT#5,TTE$
1060 IF LEN(TTE$)<8 GOTO 1170
1070 LN=LEN(TTE$)
1080 LN=LN-7
1090 T$=LEFT$(TTE$,LN)
1100 TE$=RIGHT$(TTE$,7)
1110 TW$=RIGHT$(T$,LN-2):TS=VAL(TW$)
1120 T=(INT((VAL(TW$)/60)*100))/100
1130 TE=(INT((((VAL(TE$)/800)/0.0429)-5)*10))/10
1140 WO=INT((TE-10)*2.5)+24
1150 ATE=TE+ATE
1160 NEXT ZX
1170 AVT=ATE/(ZX-1)
1180 CLOSE 5,8,5
1190 CLOSE 15,8,15
1200 SH(VX)=XH
1210 ST$(VX)=H$+":"+MT$
1220 AVT=(INT(AVT*10))/10
1230 AVT(VX)=AVT
1240 NEXT VX
1250 OPEN 7,4
1260 OPEN 6,4,6:CMD6
1270 OPEN 2,4,2:PRINT#2,TAB(8)"99.99"TAB(3)"99.9":CLOSE2
1280 OPEN 1,4,1
1290 PRINT#6,CHR$(24)
1300 PRINT#7,".                                    "
1310 PRINT#7,"                                       "
1320 PRINT#7,"                                   "
1330 PRINT#7,"   "
1340 PRINT#7,"   "
1350 PRINT#7,"   "
1360 PRINT#7,"                 SUMMARY OF THE DATA COLLECTE "
1370 PRINT#7,"       ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━"
1380 PRINT#7,"  "
1390 PRINT#7,"            STARTING   ";D1$;"/";M1$;"/";Y1$;" AT ";ST$(1)
1400 PRINT#7,"            FROM DATA FILE ━━━━ ";QNN$;" 1  THROUGH  ";NZ
1410 PRINT#7,"       ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━"
```

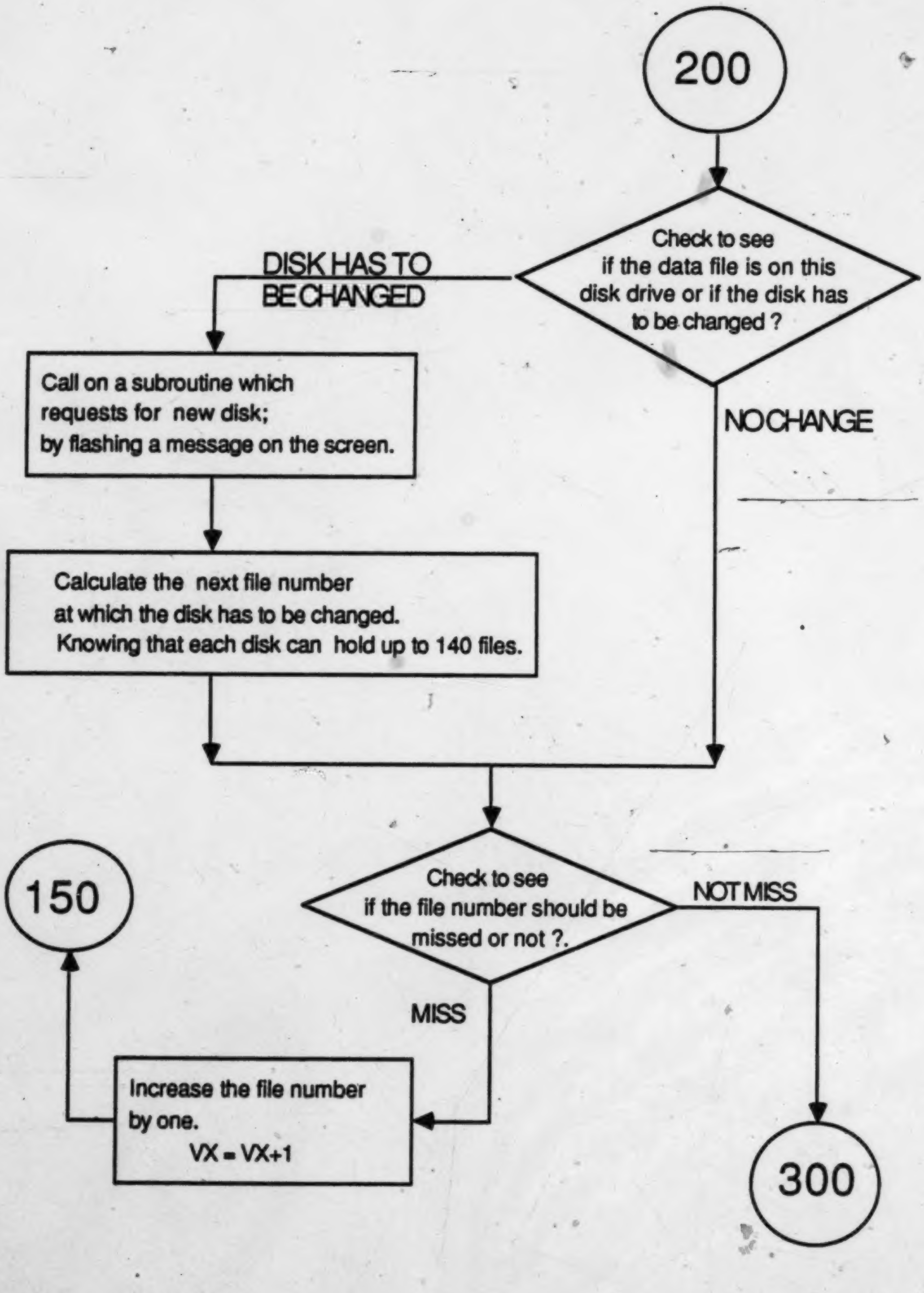
```
1420 PRINT#7,"                    "
1430 PRINT#7,"                  "
1440 PRINT#7,"COMMENT ";COM$
1450 PRINT#7,"                          "
1460 PRINT#7,"                           "
1470 PRINT#7," TIME    OUR     TEMP"
1480 PRINT#7,"OF DAY  MG/L.HR   C "
1490 PRINT#7,TAB(20)" 06   10   14   18   22   26   30   34   38"
1500 PRINT#6,CHR$(1)
1510 PRINT#7,TAB(65)" 42   46   50   "
1520 PRINT#6,CHR$(24)
1530 PRINT#7,"────────────"
1540 PRINT#6,CHR$(1)
1550 PRINT#7,TAB(20)"++──+──+──+──+──+OUR+MG/L.HR─+──+──+──+"
1560 PRINT#7,TAB(75)"───"
1570 PRINT#6,CHR$(24)
1580 FOR OX=1 TO NZ
1590 W2=(SH(OX)-6)*(2.5/2)
1600 IF W2<0 THEN W2=0
1610 W3=(AVT(OX)-12)*5
1620 IF W3<0 THEN W3=0
1630 NS=VAL(LEFT$(ST$(OX),2))
1640 IF NS<OS THEN GOSUB 1760
1650 OS=NS
1660 PRINT#7,ST$(OX)
1670 PRINT#6,CHR$(1)
1680 PRINT#1,SH(OX),AVT(OX)
1690 PRINT#7,TAB(20)"|"TAB(W2)"+"
1700 PRINT#7,TAB(20)"|"TAB(W3)"."
1710 PRINT#6,CHR$(24)
1720 NEXT OX
1730 CLOSE 6
1740 CLOSE 7:CLOSE 1
1750 END
1760 PRINT#6,CHR$(24)
1770 PRINT#7,"────────────"
1780 PRINT#6,CHR$(1)
1790 PRINT#7,TAB(20)"++──+──+──+──+──+OUR+MG/L.HR─+──+──+──+"
1800 PRINT#7,TAB(75)"───"
1810 PRINT#6,CHR$(1)
1820 RETURN
```

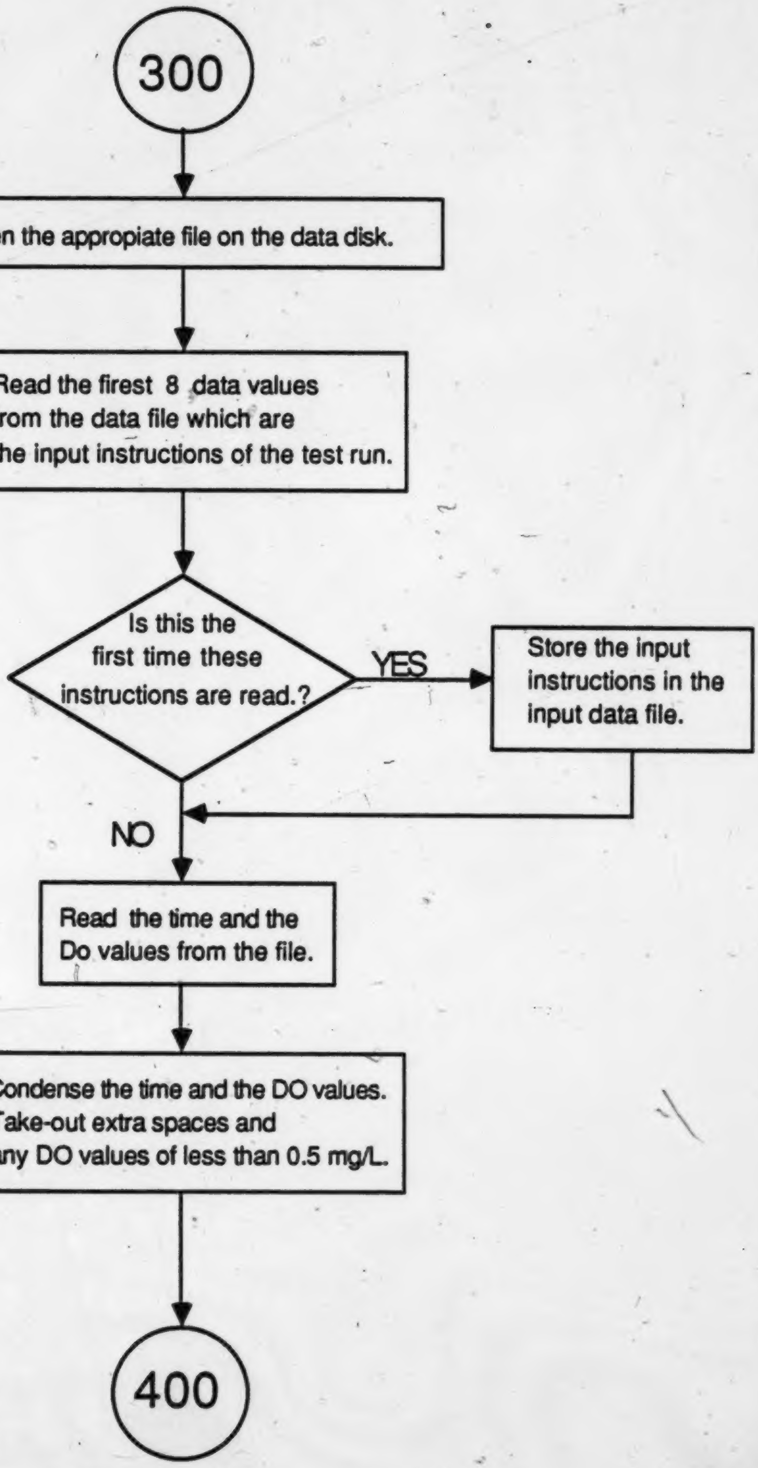
Section B4.

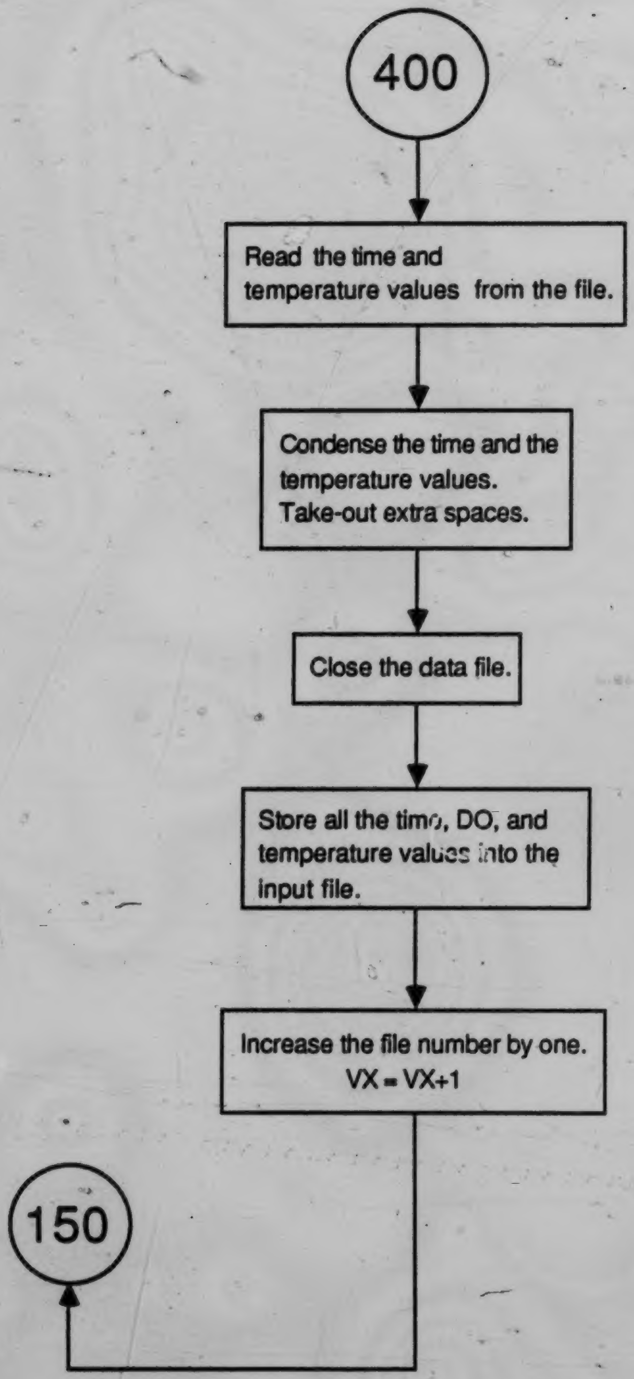
Flowchart of The "DTD.CONDENSER" Program


START
Questionnaire for input of instructions
Name of the file which is to be condenced ?
In the case of a string of files only give the original or the main name?.
Number of files to be read ?
Which disk drive is the data disk under ?
How many files are there on the first disk ?
Are there any files Which have to be missed ?
NO
YES
How many files are there to be missed ?
Type the suffix of the files to be missed .
Questionnaire for input of instructions.
Under what file name should the new condensed file to be stored ?
Under which disk drive ?
100


100
Press any key to start the operation.
Open a receiving file on a specified disk to store the condensed file
Calculate the total number of files to read; if there are any files which have to be missed this number will differ from the input number.
Print in the input-file the total number of files.
Do the following for VX=1 to Total number of files.
VX > Total number of files.
Close the input file
150
200
END


200
Check to see if the data file is on this disk drive or if the disk has to be changed ?
DISK HAS TO BE CHANGED
NO CHANGE
Call on a subroutine which requests for new disk; by flashing a message on the screen.
Calculate the next file number at which the disk has to be changed. Knowing that each disk can hold up to 140 files.
Check to see if the file number should be missed or not ?.
NOT MISS
MISS
150
Increase the file number by one. VX = VX+1
300


300
Open the appropiate file on the data disk.
Read the firest 8 data values from the data file which are the input instructions of the test run.
Is this the first time these instructions are read.?
YES
Store the input instructions in the input data file.
NO
Read the time and the Do values from the file.
Condense the time and the DO values. Take-out extra spaces and any DO values of less than 0.5 mg/L.
400


400
Read the time and temperature values from the file.
Condense the time and the temperature values. Take-out extra spaces.
Close the data file.
Store all the time, DO, and temperature values into the input file.
Increase the file number by one. VX = VX+1
150

Listing of The "DTD.CONDENSER" Program

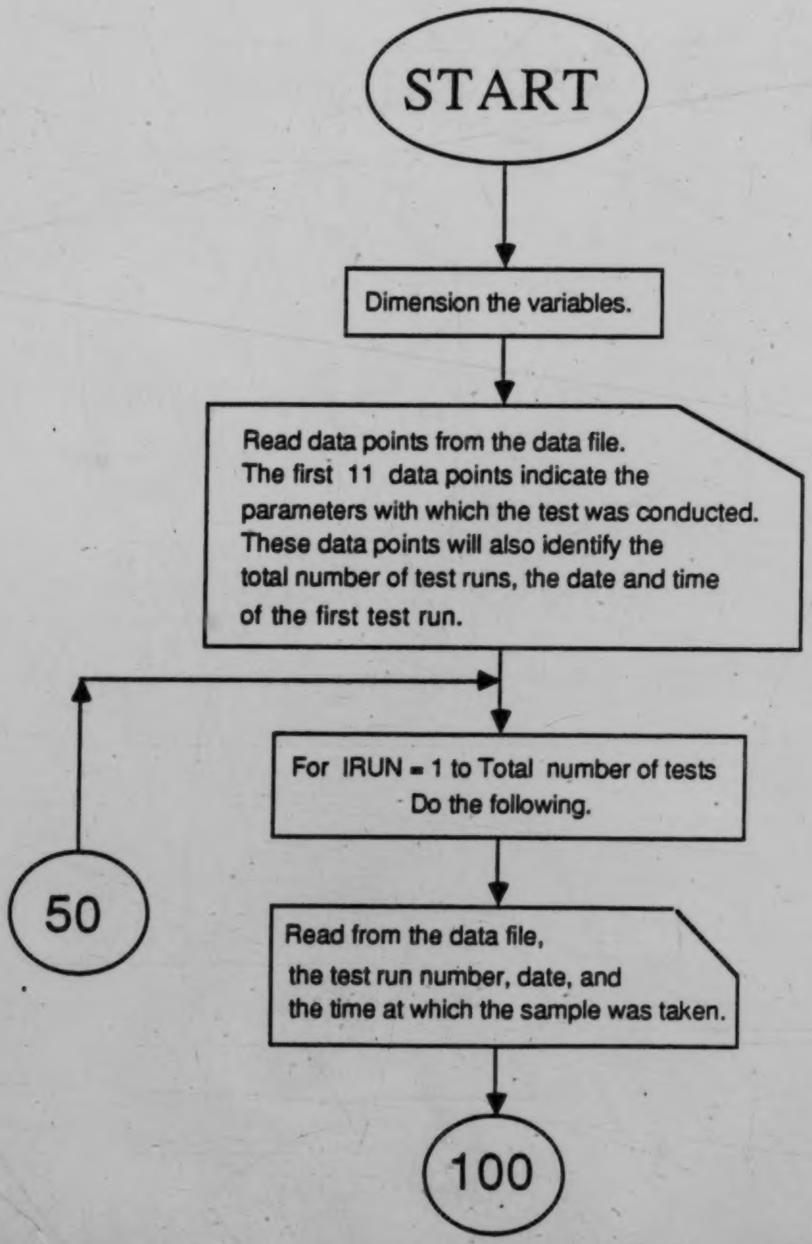
```
10 REM********************************
20 REM
30 REM     THIS PROGRAM WILL CONDENSE
40 REM   A SET OF FILES INTO ONE
50 REM   LONG FILE. THE OBJECTIVES
60 REM   BEING TO REDUCE THE NUMBER OF
70 REM   FILES WHICH ARE TO BE
80 REM   TRANSFERRED TO UNIVERCITY OF
90 REM   ALBERTA COMPUTING SYSTEM (MTS)
100 REM     EACH DATA FILE WILL NOT
110 REM  BE INDEPENDENTLY IDENTIFIED
120 REM  EXCEPT WITH THE EXISTING
130 REM  INFORMATION WITHIN THE FILE.
140 REM
150 REM
160 REM     PROGRAMED BY: BIJAN AIDUN
170 REM
180 REM     DATE        : SEPT 19, 85
190 REM
200 REM**********************************
210 DIM X$(500)
220 DIM WZ(100)
230 GOTO 620
240 REM********************************
250 REM
260 REM   SUBROUTINE TO COMPACT DATA
270 REM
280 REM********************************
290 LN=LEN(XD$)
300 IF LN<2 THEN RETURN
310 DOX$=RIGHT$(XD$,6)
320 FITX$=LEFT$(XD$,LN-9)
330 ITX$=RIGHT$(FITX$,LN-10)
340 IF VAL(DOX$)<0.5 GOTO 420
350 D1$=LEFT$(DOX$,1)
360 BSO$=RIGHT$(DOX$,3)
370 D2$=LEFT$(BSO$,1)
380 D3$=RIGHT$(BSO$,1)
390 Z=Z+1
400 X$(Z)=ITX$+","+D1$+D2$+D3$
410 RETURN
420 MO=MO+1
430 IF VAL(ITX$)<800 GOTO 350
440 IF MO<3 GOTO 350
450 RETURN
460 REM***********************************
470 REM
480 REM   SUBROUTINE TO CALL FOR NEW DISK
490 REM
500 REM**********************************
510 PRINT"]QQQQQQQQQQ   CHANGE THE DATA DISK IN DRIVE #";DX$
520 PRINT"Q     LAST FILE READ WAS ";CN$
530 PRINT"Q      PRESS ANY KEY TO RESTART"
540 GET KY$
550 PRINT"SQQQQQQQQ                                         "
560 PRINT"SQQQQQQQQQ****************************************"
570 PRINT"SQQQQQQQQQQQQQQQ                                          "
580 PRINT"SQQQQQQQQQQQQQQQ******************************************"
590 IF KY$="" GOTO 540
600 NDO=NDO+140
610 RETURN
```

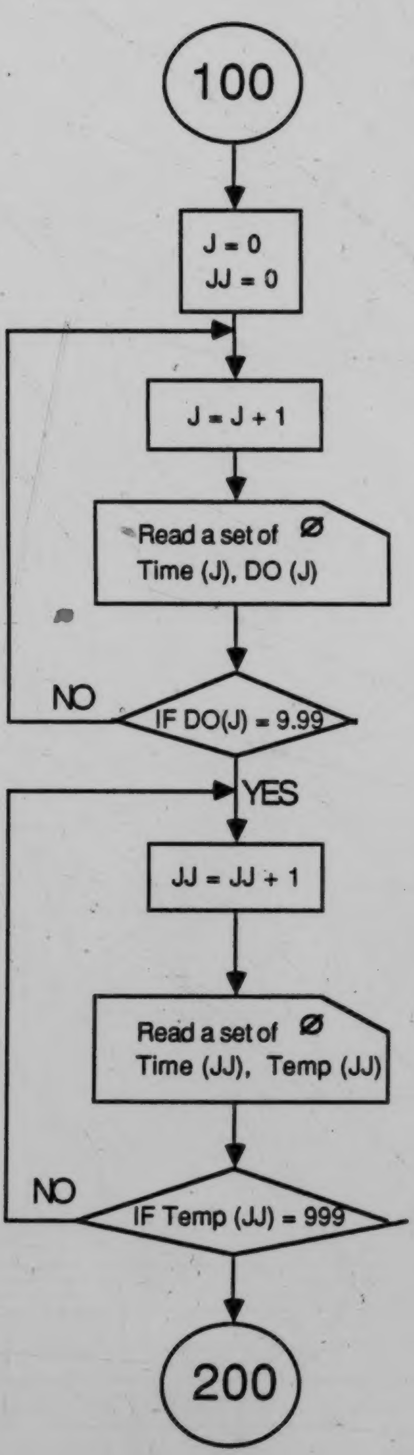
```
620 PRINT"]QQQNAME OF THE FILE "
630 PRINT"WHICH IS TO BE CONDENSED ?"
640 PRINT"QIN THE CASE OF STRING OF FILES"
650 PRINT"ONLY GIVE THE ORIGINAL OR MAIN NAME "
660 INPUT"Q.............................";XN$
670 INPUT"QQNUMBER OF FILES TO BE READ";NO
680 PRINT"QQWHICH DISK DRIVE":INPUT"IS THE DATA DISK UNDER";DX$
690 PRINT"QQHOW MANY FILES ARE"
700 INPUT"THERE ON THE FIRST DISK ";ND0
710 ANO=0:LNO=0
720 PRINT"]QQQARE THERE ANY FILES "
730 INPUT"QWHICH HAS TO BE MISSED";YN$
740 IF ASC(YN$)=89 GOTO 770
750 IF ASC(YN$)<>78 GOTO 720
760 GOTO 810
770 INPUT"QQQNUMBER OF FILES TO BE MISSED";WN
780 FOR WW=1 TO WN
790 INPUT"QQSUFFIX NUMBER OF FILE TO BE MISSED";WZ(WW)
800 NEXT WW
810 PRINT"]QQQUNDER WHAT FILE NAME SHOULD"
820 INPUT"QTHE NEW CONDENSED FILE BE STORED";NNAME$
830 INPUT"QQQUNDER WHICH DISK DRIVE";DD$
840 PRINT"]QQQQQQ PRESS ANY KEY TO START"
850 GET KY$
860 PRINT"]QQQQQQQQQ                       "
870 PRINT"]QQQQQQQQQ**********************"
880 IF KY$="" GOTO 850
890 REM***************************
900 REM
910 REM  READ AND STORE DATA POINTS
920 REM
930 REM****************************
940 Z=0:ZX=1:SN=0
950 OPEN3,8,3,DD$+":"+NNAME$+",S,W"
960 IF ASC(YN$)=89 THEN KK=NO-WN:GOTO 980
970 KK=NO
980 PRINT#3,KK:PRINT#3,NNAME$
990 FOR VX=1 TO NO
1000 Z=0:MO=0
1010 IF VX=(ND0+1) THEN GOSUB 510
1020 IF ASC(YN$) <>89 GOTO 1060
1030 FOR WW=1 TO WN
1040 IF VX=WZ(WW)THEN NEXT VX
1050 NEXT WW
1060 SF$=STR$(VX)
1070 CN$=XN$+SF$
1080 PRINT"QQREADING DATA IN FILE  >>> ";CN$
1090 PRINT"QD>> READING THE FILE"
1100 OPEN5,8,5,DX$+":"+CN$+",S,R"
1110 FOR Z=1 TO 8
1120 INPUT#5,XTR$
1130 LN=LEN(XTR$)
1140 IF LN<=1 THEN X$(Z)=XTR$:GOTO 1160
1150 X$(Z)=RIGHT$(XTR$,LN-1)
1160 NEXT Z
1170 IF VX>1 THEN Z=Z-7
1180 INPUT#5,XD$
1190 S$=RIGHT$(XD$,3)
1200 IF VAL(S$)=999  THEN Z=Z+1:X$(Z)="999,999": GOTO 1230
1210 GOSUB 290
1220 GOTO 1180
1230 INPUT#5,XD$
1240 S$=RIGHT$(XD$,3)
1250 IF VAL(S$)=999  THEN Z=Z+1:X$(Z)="999,999": GOTO 1280
1260 GOSUB 1420
1270 GOTO 1230
1280 CLOSE5,8,5
```

```
1290 PRINT">>> SAVING  THE FILE"
1300 PRINT#3,VX
1310 FOR I=1 TO Z
1320 PRINT#3,X$(I)
1330 NEXT I
1340 NEXT VX
1350 CLOSE3,8,3
1360 END
1370 REM*****************************
1380 REM
1390 REM   SUBROUTINE TO COMPACT DATA
1400 REM
1410 REM*****************************
1420 LN=LEN(XD$)
1430 IF LN<2 THEN RETURN
1440 TEX$=RIGHT$(XD$,5)
1450 FTTX$=LEFT$(XD$,LN-8)
1460 TTX$=RIGHT$(FTTX$,LN-9)
1470 T1$=LEFT$(TEX$,1)
1480 BST$=RIGHT$(TEX$,3)
1490 T2$=LEFT$(BST$,1)
1500 T3$=RIGHT$(BST$,1)
1510 Z=Z+1
1520 X$(Z)=TTX$+","+T1$+T2$+T3$
1530 RETURN
```

Section B5.

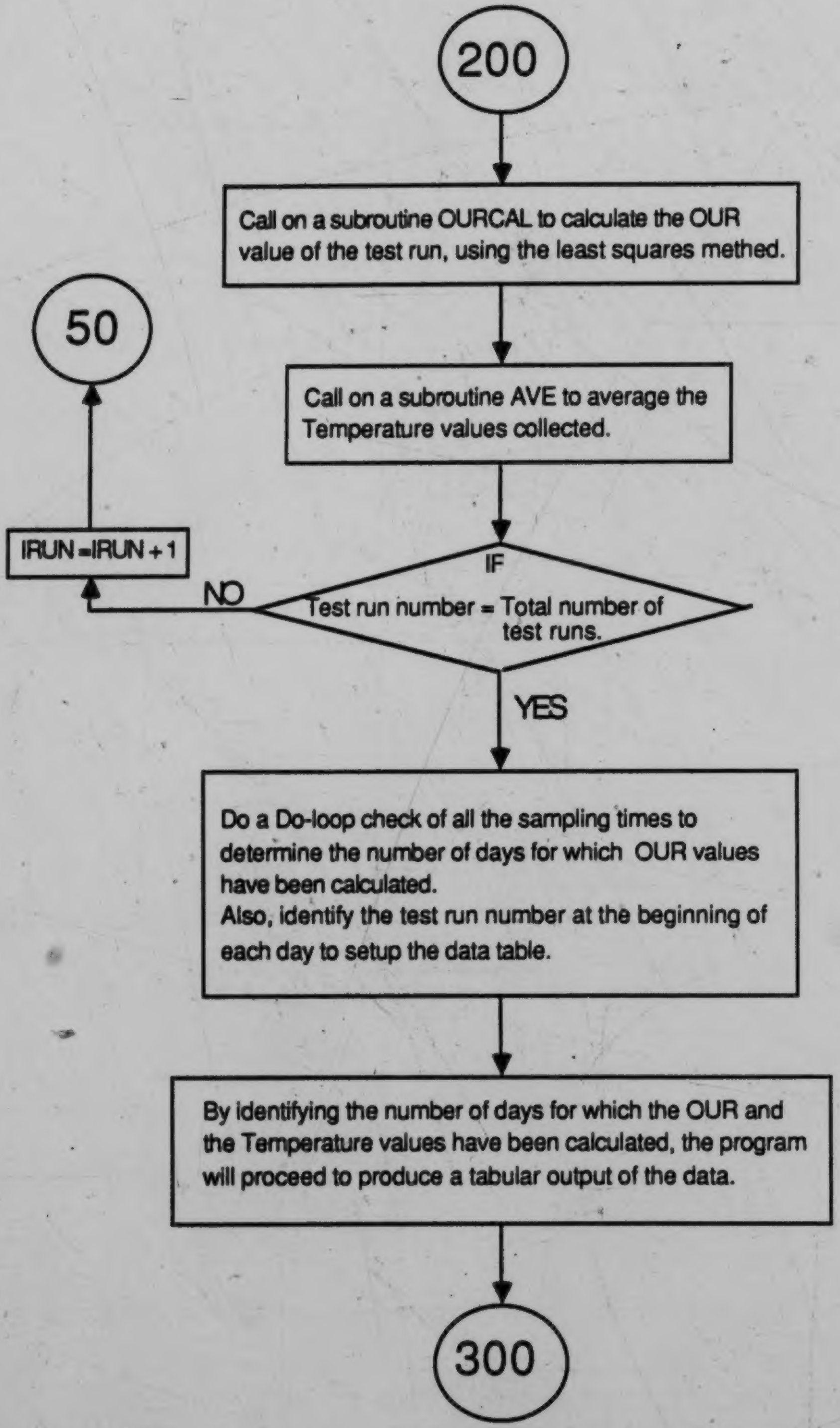
Flowchart of The "OUR.PLOT" Program

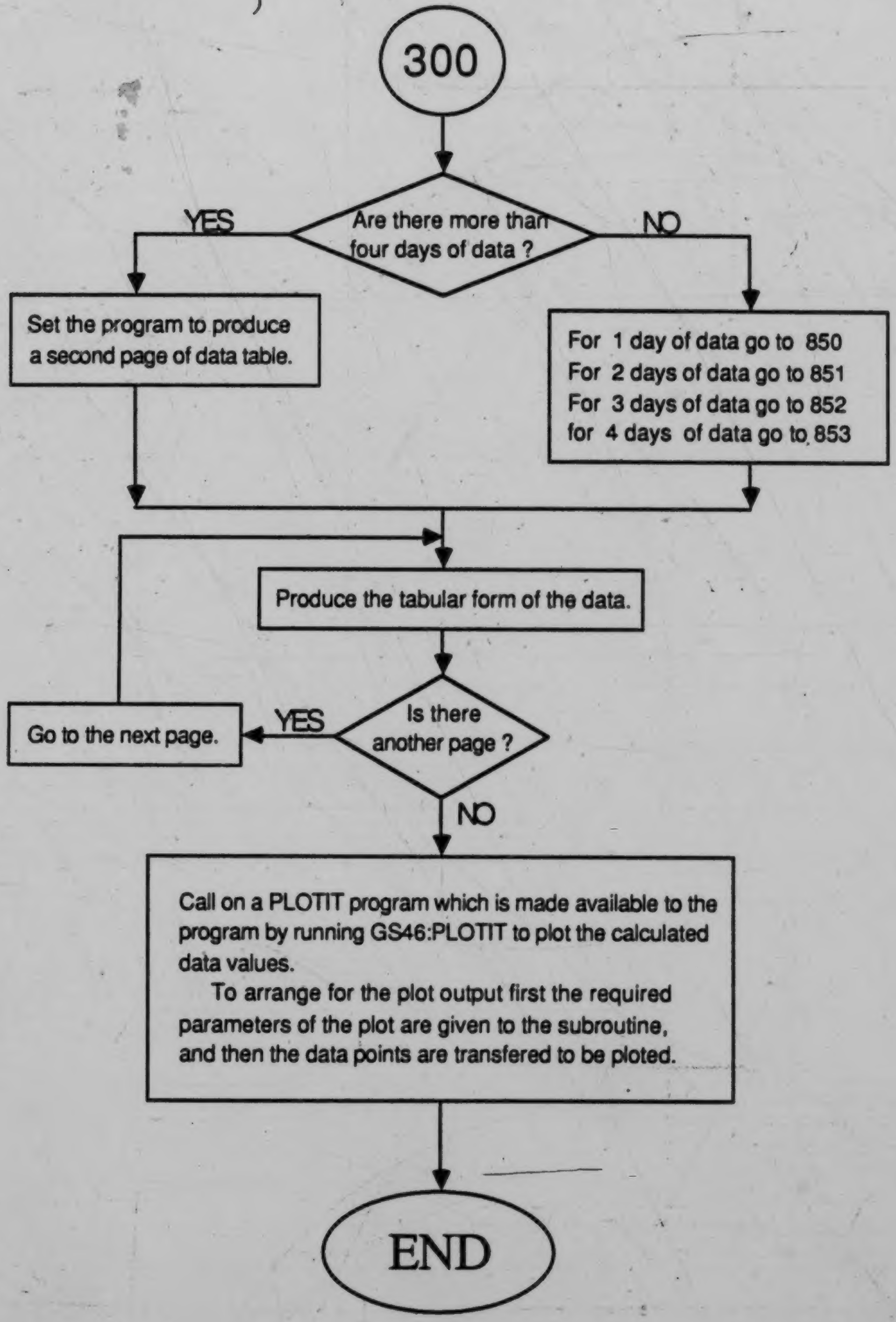

START
Dimension the variables.
Read data points from the data file.
The first 11 data points indicate the parameters with which the test was conducted.
These data points will also identify the total number of test runs, the date and time of the first test run.
For IRUN = 1 to Total number of tests Do the following.
50
Read from the data file, the test run number, date, and the time at which the sample was taken.
100

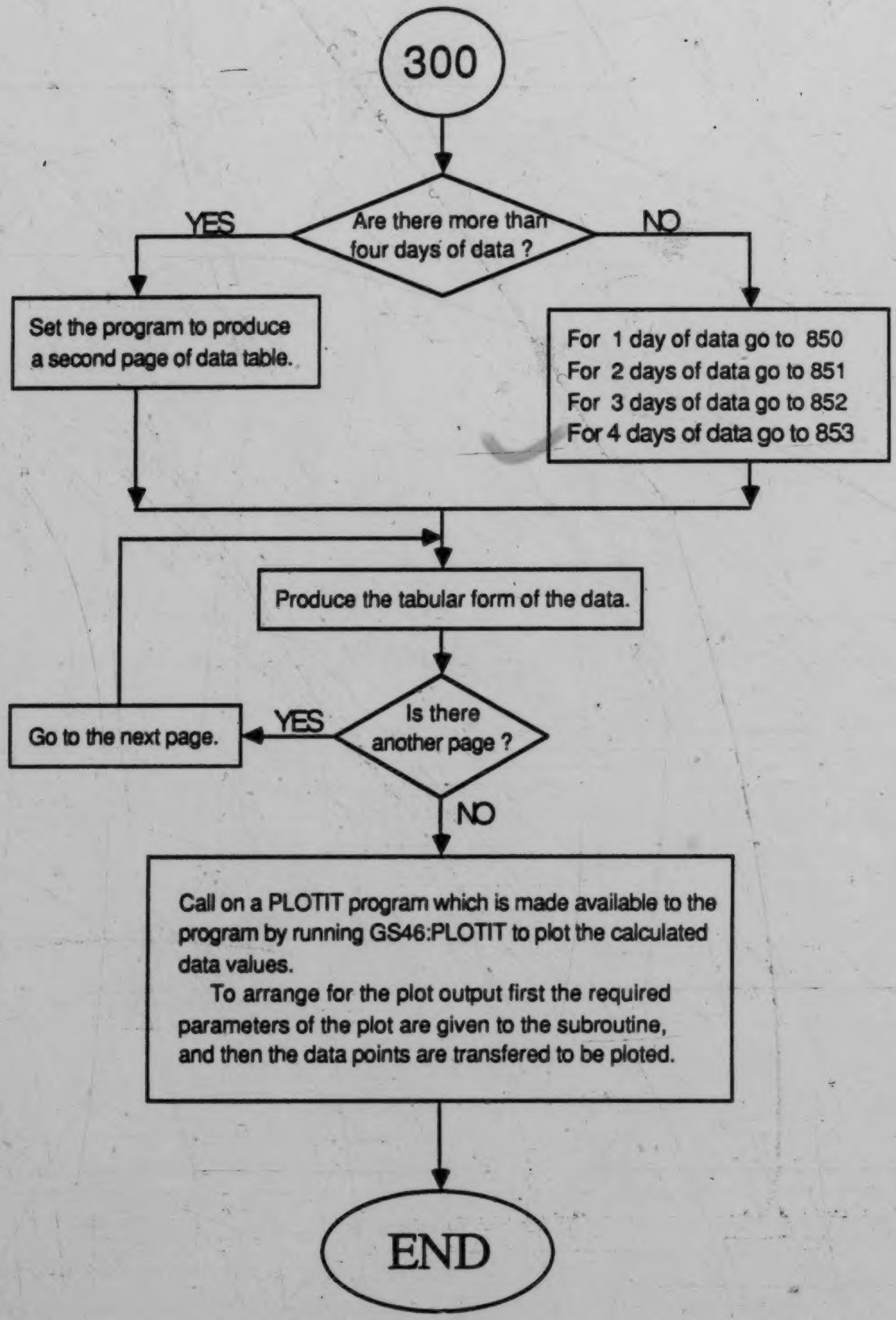

100
J = 0
JJ = 0
J = J + 1
Read a set of Ø
Time (J), DO (J)
NO
IF DO(J) = 9.99
YES
JJ = JJ + 1
Read a set of Ø
Time (JJ), Temp (JJ)
NO
IF Temp (JJ) = 999
200

NOTE Ø

The Time, DO, and Temperature values are not directly read from the data file. The data file contains the raw form of these values, some calculation have to be done to determine the true values. The reason for tranforming the raw data is to save on storage space and on trasferring time.


200
Call on a subroutine OURCAL to calculate the OUR value of the test run, using the least squares methed.
Call on a subroutine AVE to average the Temperature values collected.
IF
Test run number = Total number of test runs.
NO
IRUN =IRUN + 1
50
YES
Do a Do-loop check of all the sampling times to determine the number of days for which OUR values have been calculated.
Also, identify the test run number at the beginning of each day to setup the data table.
By identifying the number of days for which the OUR and the Temperature values have been calculated, the program will proceed to produce a tabular output of the data.
300


300
Are there more than four days of data ?
YES
NO
Set the program to produce a second page of data table.
For 1 day of data go to 850
For 2 days of data go to 851
For 3 days of data go to 852
for 4 days of data go to 853
Produce the tabular form of the data.
Is there another page ?
YES
Go to the next page.
NO
Call on a PLOTIT program which is made available to the program by running GS46:PLOTIT to plot the calculated data values.
To arrange for the plot output first the required parameters of the plot are given to the subroutine, and then the data points are transfered to be ploted.
END


300
Are there more than four days of data ?
YES
NO
Set the program to produce a second page of data table.
For 1 day of data go to 850
For 2 days of data go to 851
For 3 days of data go to 852
For 4 days of data go to 853
Produce the tabular form of the data.
Is there another page ?
YES
Go to the next page.
NO
END

Call on a PLOTIT program which is made available to the program by running GS46:PLOTIT to plot the calculated data values.

To arrange for the plot output first the required parameters of the plot are given to the subroutine, and then the data points are transfered to be ploted.

Listing of The "OUR.PLOT" Program

```
C
C
C        OXYGEN UPTAKE RATE DATA ANALYSIS PROGRAM
C              This program reads the data sets and information
C          collected by the OUR apparatus, and clculates the
C          Oxygen Uptake Rate values of the samples according
C          to the Least Squers method.
C              The calculated values are then ploted, to
C          illustrate the OUR vareations of the samples during
C          the sampling period.
C
C                Programed by:   Bijan Aidun.
C                Date        :   November 09 85
C
C
C
      DIMENSION DOTIME(500),XDO(500),ST(500),OUR(500),START(500)
      DIMENSION AVTEMP(500),DATE(500),DAI(10),TEMP(500)
      DIMENSION LH(500),LM(500),LD(10),LMO(10),LY(10)
      INTEGERS COMM(10),FILE(2)
      LOGICAL *1 FMT(1)/'*'/
C
C
C Starart of the program to read data points.
C
C
      READ(5,FMT) NTESTS
      READ(5,41) FILE
      READ(5,FMT) RNO
      READ(5,FMT) DATE(1)
      READ(5,FMT) RTIME
      READ(5,FMT) TESTT
      READ(5,FMT) AIRT
      READ(5,FMT) TMIX
      READ(5,FMT) DOT
      READ(5,FMT) TEMT
      READ(5,40) COMM
      LDAY=INT(DATE(1))
      DM=DATE(1)/100.
      D=DATE(1)/10000.
      LDM=INT(DM)
      LDO=INT(D)
      LMO=INT((D-FLOAT(LDO))*100)
      LYO=INT((DM-FLOAT(LDM))*100)+1
      EXTRA=0.0
C
C  Start of a do-loop to read all the
C  data for each test run and calculate the
C  OUR and AVERAGE TEMP values.
C
C
      DO 19 IRUN=1,NTESTS
         IF (IRUN.EQ.1) GO TO 300
         READ(5,FMT)RNO
         READ(5,FMT) DATE(IRUN)
         READ(5,FMT) RTIME
  300    RTIME=(RTIME-1000000.)/100.
         LHM=INT(RTIME)
         HM=FLOAT(LHM)/100.
         LHH=INT(HM)
```

```
              XMIN1=FLOAT(LHH)*60.
              XMIN2=(HM-FLOAT(LHH))*100.
              LM(IRUN)=INT(XMIN2)
              LH(IRUN)=LHH
              START(IRUN)=(XMIN1+XMIN2)/60.
              J=0
              JJ=0
  400         J=J+1
               READ(5,FMT) STIME,DOX
               XDO(J)=DOX/100.
               DOTIME(J)=STIME/3600.0
               IF (XDO(J).EQ.9.99) GO TO 500
              GO TO 400
  500         JJ=JJ+1
               READ(5,FMT)STT,VOLT
               TEMP(JJ)= (VOLT/(800*0.0429))-5.0
               IF (VOLT.EQ.999) GO TO 600
              GO TO 500
C
C
C    Call on subroutines to calculate the OUR and
C    Average Temperature values.
C
C
  600         CALL OURCAL(DOTIME,XDO,J,IRUN,OUR)
              CALL AVE(TEMP,JJ,IRUN,AVTEMP)
              IF(RNO.EQ.NTESTS) GO TO 444
   19   CONTINUE
C
C
C   Aranging the collection times for ploting.
C
C
  444   IDOM=0
        DO 700 IX=1,NTESTS
        IF (IX.EQ.NTESTS) GO TO 700
        IIX=IX+1
        IF (START(IX).LT.START(IIX)) GO TO 700
        IDOM=IDOM+1
        DAI(IDOM)=IX
        LDAY=INT(DATE(IIX))
        DM=DATE(IIX)/100.
        D=DATE(IIX)/10000.
        LDM=INT(DM)
        LD(IDOM)=INT(D)
        LMO(IDOM)=INT((D-FLOAT(LD(IDOM)))*100)
        LY(IDOM)=INT((DM-FLOAT(LDM))*100)+1
  700   CONTINUE
        IF (IDOM.EQ.0) GO TO 850
        DO 800 ID=1,IDOM
          IP=DAI(ID)+1
             DO 750 IZ=IP,NTESTS
             START(IZ)=START(IZ)+24.0
C            LH(IZ)=LH(IZ)+24.0
  750        CONTINUE
  800   CONTINUE
C
C
C
C
C   Write the data into a file.
C   Depending on the number of days.
C
C
C
        JNX=1
        EEX=0.0
        IF (IDOM.EQ.1) GO TO 851
        IF (IDOM.EQ.2) GO TO 852
        IF (IDOM.EQ.3) GO TO 853
        IF (IDOM.GE.4) GO TO 855
```

```
C
C   If the data is collected for less than 24-hr.
C        Data is printed one after another.
C
C
 850  WRITE(6,180)LDO,LDO,LMO,LYO
      WRITE(6,140)
      WRITE(6,160)
      WRITE(6,170)LDO,LMO,LYO
      WRITE(6,120)
      WRITE(6,100)
      WRITE(6,120)
           DO 900 JX=JNX,NTESTS
 900       WRITE(6,110) LH(JX),LM(JX),OUR(JX),AVTEMP(JX)
      WRITE(6,130)
      GO TO 999
C
C  Two days of data
C
C
 851  WRITE(6,180)LDO,LD(IDOM),LMO(IDOM),LY(IDOM)
      WRITE(6,141)
      WRITE(6,161)
      WRITE(6,171)LDO,LMO,LYO,LD(1),LMO(1),LY(1)
      WRITE(6,121)
      WRITE(6,101)
      WRITE(6,121)
      IF(EEX.EQ.1.0) GO TO 291
      KN=0
      JMAX=INT(DAI(1))
      JMAX1=JMAX+1
      JIX=JMAX1+5
        DO 891 KX=JIX,NTESTS
          LHZ=LH(KX)
          IF (LH(1).NE.LHZ) GO TO 891
          IF (KN.NE.0) GO TO 891
          KN=KX
 891    CONTINUE
      IF (KN.NE.0) GO TO 781
      KN=NTESTS
 781  DO 791 JJX=JMAX1,KN
 791  WRITE(6,151) LH(JJX),LM(JJX),OUR(JJX),AVTEMP(JJX)
 291  DO  901 JX=JNX,JMAX
          JJX=KN+JX-JNX+1
          IF (JJX.GT.NTESTS) GO  TO 911
          WRITE(6,111) LH(JX),LM(JX),OUR(JX),AVTEMP(JX),LH(JJX),
     *LM(JJX),OUR(JJX),AVTEMP(JJX)
          GO TO 901
 911      WRITE(6,111) LH(JX),LM(JX),OUR(JX),AVTEMP(JX)
 901  CONTINUE
      WRITE(6,131)
      GO TO 999
C
C  Three days of data.
C
C
 852  WRITE(6,180)LDO,LD(IDOM),LMO(IDOM),LY(IDOM)
      WRITE(6,142)
      WRITE(6,162)
      WRITE(6,172)LDO,LMO,LYO,LD(1),LMO(1),LY(1),LD(2),LMO(2),LY(2)
      WRITE(6,122)
      WRITE(6,102)
      WRITE(6,122)
      IF(EEX.EQ.1.0) GO TO 292
      KN=0
      JMAX=INT(DAI(1))
      JMAX1=JMAX+1
      JJMAX=INT(DAI(2))
      JJMAX1=JJMAX+1
      JJJX=JJMAX
      JIX=JMAX1+5
```

```
       DO 892 KX=JIX,JJMAX
            LHZ=LH(KX)
            IF (LH(1).NE.LHZ) GO TO 892
            IF (KN.NE.0) GO TO 892
            KN=KX
 892   CONTINUE
       DO 792 JJX=JMAX1,KN
          JJJX=JJJX+1
          IF (JJJX.GT.NTESTS) GO TO 692
          WRITE(6,152) LH(JJX),
     *LM(JJX),OUR(JJX),AVTEMP(JJX),LH(JJJX),LM(JJJX),OUR(JJJX),
     *AVTEMP(JJJX)
          GO TO 792
 692      WRITE(6,152)LH(JJX),LM(JJX),OUR(JJX),AVTEMP(JJX)
 792   CONTINUE
 292   DO 902 JX=JNX,JMAX
          JJX=KN+JX-JNX+1
          JJJX=JJJX+1
          IF (JJJX.GT.NTESTS) GO TO 912
          WRITE(6,112) LH(JX),LM(JX),OUR(JX),AVTEMP(JX),LH(JJX),
     *LM(JJX),OUR(JJX),AVTEMP(JJX),LH(JJJX),LM(JJJX),OUR(JJJX),
     *AVTEMP(JJJX)
          GO TO 902
 912      WRITE(6,112) LH(JX),LM(JX),OUR(JX),AVTEMP(JX),LH(JJX),
     *LM(JJX),OUR(JJX),AVTEMP(JJX)
 902   CONTINUE
       WRITE(6,132)
       GO TO 999
C
C   Foure days of data.
C
C
 853   WRITE(6,180)LDO,LD(IDOM),LMO(IDOM),LY(IDOM)
       WRITE(6,143)
       WRITE(6,163)
       WRITE(6,173)LDO,LMO,LYO,LD(1),LMO(1),LY(1),LD(2),LMO(2),
     *LY(2),LD(3),LMO(3),LY(3)
       WRITE(6,123)
       WRITE(6,103)
       WRITE(6,123)
       IF(EEX.EQ.1.0) GO TO 293
       KN=0
       JMAX=INT(DAI(1))
       JMAX1=JMAX+1
       JJMAX=INT(DAI(2))
       JJMAX1=JJMAX+1
       JJJX=JJMAX
       JJJMAX=INT(DAI(3))
       JJJXAM=JJJMAX+1
       JJJJX=JJJMAX
       JIX=JMAX1+5
       DO 893 KX=JIX,JJMAX
          LHZ=LH(KX)
          IF (LH(1).NE.LHZ)GO TO 893
          IF (KN.NE.0) GO TO 893
          KN=KX
 893   CONTINUE
       DO 793 JJX=JMAX1,KN
          JJJX=JJJX+1
          JJJJX=JJJJX+1
          IF (JJJJX.GT.NTESTS) GO TO 693
          WRITE(6,153) LH(JJX),
     *LM(JJX),OUR(JJX),AVTEMP(JJX),LH(JJJX),LM(JJJX),OUR(JJJX),
     *AVTEMP(JJJX),LH(JJJJX),LM(JJJJX),OUR(JJJJX),AVTEMP(JJJJX)
          GO TO 793
 693      WRITE(6,153) LH(JJX),
     *LM(JJX),OUR(JJX),AVTEMP(JJX),LH(JJJX),LM(JJJX),OUR(JJJX),
     *AVTEMP(JJJX)
 793   CONTINUE
 293   DO 903 JX=JNX,JMAX
          JJX=KN+JX-JNX+1
          JJJX=JJJX+1
          JJJJX=JJJJX+1
          IF (JJJJX.GT.NTESTS) GO TO 913
          WRITE(6,113) LH(JX),LM(JX),OUR(JX),AVTEMP(JX),LH(JJX),
     *LM(JJX),OUR(JJX),AVTEMP(JJX),LH(JJJX),LM(JJJX),OUR(JJJX),
     *AVTEMP(JJJX),LH(JJJJX),LM(JJJJX),OUR(JJJJX),AVTEMP(JJJJX)
          GO TO 903
 913      WRITE(6,113) LH(JX),LM(JX),OUR(JX),AVTEMP(JX),LH(JJX),
     *LM(JJX),OUR(JJX),AVTEMP(JJX),LH(JJJX),LM(JJJX),OUR(JJJX),
     *AVTEMP(JJJX)
 903   CONTINUE
       WRITE(6,133)
       GO TO 999
C
C   If there are more than 4 days of data the data
C   will only be printed for 4 days; on one page
C   and the countinuation will be on the second page.
C
 855   EXTRA=IDOM
       EEX=2.0
       IDOM=3
       GO TO 853
C
C
C  Write the second page of data if it is nessacerly.
C
C
 999  WRITE(6,190)FILE
       IF(EEX.EQ.2.0) GO TO 908
       GO TO 909
 908  EJN=EXTRA-3.0
      WRITE(6,105)
      EEX=1.0
      LDO=LD(4)
      LMO=LMO(4)
      LYO=LY(4)
      IDOM=4
      JNX=INT(DAI(4))+1
      IF(EJN.EQ.1.0) GO TO 850
      IDOM=5
      LD(1)=LD(5)
      LMO(1)=LMO(5)
      LY(1)=LY(5)
      JMAX=INT(DAI(5))
      KN=JMAX
      IF(EJN.EQ.2.0)GO TO 851
      IDOM=6
      LD(2)=LD(6)
      LMO(2)=LMO(6)
      LY(2)=LY(6)
      JJJX=INT(DAI(6))
      IF(EJN.EQ.3.0) GO TO 852
      IDOM=7
      LD(3)=LD(7)
      LMO(3)=LMO(7)
      LY(3)=LY(7)
      JJJJX=INT(DAI(7))
      GO TO 853
C
C
C   Call thePLOTIT program to plot the data values.
C   Option of ploting scales are 4,5,6,7 days on the X-axeses.
C
C
 909  CALL GPEP1(0.18,0.15,0.1)
      CALL GPEP2(0.5,0.5)
      CALL GPEP3(1,2,0.5,TRUE,1.5,-1.0,TRUE)
      CALL GPEP4('ROMANTX')
      CALL GPEP5(1,1,2)
      CALL GPEP6(1.5,0.7,1.55)
      CALL GPEP8(0.5,0.05,0.12,'LEGEND',6)
      CALL GPEP13(0.05)
      CALL GPEP14(TRUE,0.5,8.0,4,0.0,4)
      CALL GPEP15(30.0,52.0,60.0,59.0)
      IF(EXTRA.LE.3) GO TO 304
      IF(EXTRA.EQ.4) GO TO 305
      IF(EXTRA.EQ.5) GO TO 306
      IF(EXTRA.GE.6) GO TO 307
  307 CALL PLOTIT(START,OUR,NTESTS,1,1,1,2,0.0,6.0,28.0,8.0,
     *6.0,9.0,0)
      CALL PLOTIT(START,AVTEMP,NTESTS,4,1,1,1,0.0,6.0,28.0,
     *8.0,6.0,9.0,0)
      GO TO 310
  306 CALL PLOTIT(START,OUR,NTESTS,1,1,1,2,0.0,6.0,24.0,8.0,
     *6.0,9.0,0)
      CALL PLOTIT(START,AVTEMP,NTESTS,4,1,1,1,0.0,6.0,24.0,
     *8.0,6.0,9.0,0)
      GO TO 310
  305 CALL PLOTIT(START,OUR,NTESTS,1,1,1,2,0.0,6.0,20.0,8.0,
     *6.0,9.0,0)
      CALL PLOTIT(START,AVTEMP,NTESTS,4,1,1,1,0.0,6.0,20.0,
     *8.0,6.0,9.0,0)
      GO TO 310
  304 CALL PLOTIT(START,OUR,NTESTS,1,1,1,2,0.0,6.0,16.0,8.0,
     *6.0,9.0,0)
      CALL PLOTIT(START,AVTEMP,NTESTS,4,1,1,1,0.0,6.0,16.0,
     *8.0,6.0,9.0,0)
C310  CALL PLOTIT(START,OUR,NTESTS,0,1,1,2,0.0,2.0,10.0,5.0,
C    *4.0,10.0,0)
  310 CALL GPEP1(0.093,0.085,0.065)
      CALL GPEP2(0.25,0.25)
      CALL GPEP3(1,5,0.5,TRUE,1,11,-0.5,TRUE)
      CALL GPEP4('ROMANTX')
      CALL GPEP5(1,1,2)
      CALL GPEP6(0.75,0.45,0.82)
      CALL GPEP8(0.25,0.025,0.07,'LEGEND',6)
      CALL GPEP13(0.03)
      CALL GPEP14(TRUE,0.1,4.0,4,0.0,4)
      CALL GPEP15(30.0,52.0,60.0,59.0)
      IF(EXTRA.LE.3) GO TO 404
      IF(EXTRA.EQ.4) GO TO 405
      IF(EXTRA.EQ.5) GO TO 406
      IF(EXTRA.GE.6) GO TO 407
  407 CALL PLOTIT(START,OUR,NTESTS,1,1,1,2,0.0,12.0,14.0,8.0,
     *12.0,4.5,0)
      CALL PLOTIT(START,AVTEMP,NTESTS,4,1,1,1,0.0,12.0,14.0,
     *8.0,12.0,4.5,0)
      GO TO 410
  406 CALL PLOTIT(START,OUR,NTESTS,1,1,1,2,0.0,12.0,12.0,8.0,
     *12.0,4.5,0)
      CALL PLOTIT(START,AVTEMP,NTESTS,4,1,1,1,0.0,12.0,12.0,
     *8.0,12.0,4.5,0)
      GO TO 410
  405 CALL PLOTIT(START,OUR,NTESTS,1,1,1,2,0.0,12.0,10.0,8.0,
     *12.0,4.5,0)
      CALL PLOTIT(START,AVTEMP,NTESTS,4,1,1,1,0.0,12.0,10.0,
     *8.0,12.0,4.5,0)
      GO TO 410

  404 CALL PLOTIT(START,OUR,NTESTS,1,1,1,2,0.0,12.0,8.0,8.0,
     *12.0,4.5,0)
      CALL PLOTIT(START,AVTEMP,NTESTS,4,1,1,1,0.0,12.0,8.0,
     *8.0,12.0,4.5,0)
      GO TO 410
  410 CALL PLOTIT(START,OUR,NTESTS,0,1,1,2,0.0,2.0,10.0,5.0,
     *4.0,10.0,0)
C
C
C   Format statements.
C
C
   40  FORMAT(2A10)
   41  FORMAT(2A4)
  190  FORMAT(///15X,'These data were collected under file ',2A4)
```

```
   100  FORMAT(47X,'    TIME      OUR    TEMP',
     */47X,'   Hr:Min     mg/1     C ')
  110  FORMAT(50X,I2,':',I2,3X,F7.2,F7.1)
  101  FORMAT(33X,'     TIME       OUR    TEMP      TIME      OUR',
     *4X,'TEMP',
     */33X,'    Hr:Min     mg/1    C      Hr:Min     mg/1',
     *4X,' C ')
  111  FORMAT(37X,I2,':',I2,3X,F7.2,F7.1,6X,I2,':',I2,3X,F7.2,F7.1)
  151  FORMAT(64X,I2,':',I2,3X,F7.2,F7.1)
  102   FORMAT(20X,'    TIME       OUR    TEMP       TIME      OUR',
     *4X,'TEMP       TIME       OUR    TEMP',
     */20X,'   Hr:Min     mg/1     C       Hr:Min     mg/1',
     *4X,' C       Hr:Min     mg/1     C ')
  112  FORMAT(23X,I2,':',I2,3X,F7.2,F7.1,6X,I2,':',I2,3X,F7.2,F7.1,
     *6X,I2,':',I2,3X,F7.2,F7.1)
  152  FORMAT(51X,I2,':',I2,3X,F7.2,F7.1,
     *6X,I2,':',I2,3X,F7.2,F7.1)
  103   FORMAT(10X,'    TIME       OUR    TEMP       TIME      OUR',
     *4X,'TEMP       TIME       OUR    TEMP       TIME      OUR',
     *4X,'TEMP',
     */10X,'   Hr:Min     mg/1     C       Hr:Min     mg/1',
     *4X,' C       Hr:Min     mg/1     C       Hr:Min     mg/1',
     *4X,' C  ')
  113  FORMAT(13X,I2,':',I2,3X,F7.2,F7.1,6X,I2,':',I2,3X,F7.2,F7.1,
     *6X,I2,':',I2,3X,F7.2,F7.1,6X,I2,':',I2,3X,F7.2,F7.1)
  153  FORMAT(41X,I2,':',I2,3X,F7.2,F7.1,
     *6X,I2,':',I2,3X,F7.2,F7.1,6X,I2,':',I2,3X,F7.2,F7.1)
  105  FORMAT('1'////////////////////50X,'Continuation from the ',
     *'last page.')
  120  FORMAT(47X,'|        |       |       |')
  130  FORMAT(47X,'!        !       !       !')
  121  FORMAT(33X,'|         |       |       ||         |',
     *8X,'|       |')
  131  FORMAT(33X,'!         !       !       !!         !',
     *8X,'!       !')
  122  FORMAT(20X,'|        |       |       ||         |',
     *8X,'|       ||       |       |       |')
  132  FORMAT(20X,'!        !       !       !!         !',
     *8X,'!       !!       !       !       !')
  123  FORMAT(10X,'|        |       |       ||         |',
     *8X,'|       ||       |       |       ||         |',
     *7X,'|',7X,'|')
  133  FORMAT(10X,'!        !       !       !!         !',
     *8X,'!       !!       !       !       !!         !',
     *7X,'!',7X,'!')
  140  FORMAT(47X,'|',26X,'|')
  160  FORMAT(59X,'DAY  1'/)
  141  FORMAT(33X,'|',26X,'||',26X,'|')
  161  FORMAT(45X,'DAY  1',21X,'DAY  2'/)
  142  FORMAT(20X,'|',26X,'||',26X,'||',26X,'|')
  162  FORMAT(32X,'DAY  1',21X,'DAY  2',21X,'DAY  3'/)
  143  FORMAT(10X,'|',26X,'||',26X,'||',26X,'||',26X,'|')
  163  FORMAT(22X,'DAY  1',21X,'DAY  2',21X,'DAY  3',
     *21X,'DAY  4'/)
  170  FORMAT(57X,I2,2X,I2,2X,I2)
  171  FORMAT(43X,I2,2X,I2,2X,I2,17X,I2,2X,I2,2X,I2)
  172  FORMAT(30X,I2,2X,I2,2X,I2,17X,I2,2X,I2,2X,I2,
     *17X,I2,2X,I2,2X,I2)
  173  FORMAT(20X,I2,2X,I2,2X,I2,17X,I2,2X,I2,2X,I2,
     *17X,I2,2X,I2,2X,I2,17X,I2,2X,I2,2X,I2)
  180  FORMAT(///////////////51X,'The Results of The Automated',
     *//51X,'Oxygen Uptake Rate Apparatus.'
     *//47X,'(For the period of ',I2,'-',I2,' / ',
     *I2,' / 19',I2,')'///////)
        STOP
        END
C
C
C   Subrutines
C
C
```

```
C   1st Subroutine to calculate the OUR values.
C
C
      SUBROUTINE OURCAL(DOTIME,XDO,J,IRUN,OUR)
      DIMENSION OUR(1),DOTIME(1),XDO(1)
      SUMX=0.0
      SUMY=0.0
      SUMXY=0.0
      SUMXX=0.0
      CN=0.0
      J=J-1
 1000   DO 1010 I=1,J
          IF (DOTIME(I).LE.0.075) GO TO 1010
          IF (XDO(I).LT.1.0) GO TO 1010
          IF (XDO(I).EQ.999.0) GO TO 1010
          CN=CN+1
          SUMX=SUMX+DOTIME(I)
          SUMY=SUMY+XDO(I)
          SUMXY=SUMXY+XDO(I)*DOTIME(I)
          SUMXX=SUMXX+DOTIME(I)**2
 1010   CONTINUE
C
C  Compute averages
C
 1020 IF (CN.NE.0.0)GO TO 1021
 1025 OUR(IRUN)=0.00
      GO TO 1030
 1021 XAV=SUMX/CN
      YAV=SUMY/CN
C
C  Compute corrected sums and cross products.
C
      CSCP=SUMXY-SUMX*SUMY/CN
      CSS=SUMXX-SUMX**2/CN
C
C  Calculate the OUR values
C
      IF (CSS.EQ.0.0) GO TO 1025
      OUR(IRUN)=(CSCP/CSS)*(1-2)
 1030 RETURN
      END
C
C
C  2ED Subroutine
C  To calculate the average temperatures.
C
C
      SUBROUTINE AVE(TEMP,JJ,IRUN,AVTEMP)
        DIMENSION AVTEMP(1),TEMP(1)
        NJ=JJ-1
        IF (NJ.NE.0.0) GO TO 2002
        AVTEMP(IRUN)=0.0
        GO TO 2001
 2002   TOTAL=0.0
      DO 2000 I=1,NJ
 2000 TOTAL=TOTAL+TEMP(I)
        AVTEMP(IRUN)=TOTAL/NJ
 2001   RETURN
        END
End of file
```

APPENDIX C. Listing of Raw Data and Printout Examples.

In this Appendix a listing of the raw data for a test run which is collected on a flopy disk is given as an example. A copy of the printouts produced by different software programs, are also included in this Appendix. The Appendix consists of the following sections.

Section

C1. Listing of the raw data.

C2. Printout of the BA.PRINTOUT program.
(On Commodore Printer)

C3. Printout of the BA.SUMMARY program.
(On Commodore Printer)

C4. Printout of the OUR.PLOT program.
(On The U. of A Computing System)

Section C1.

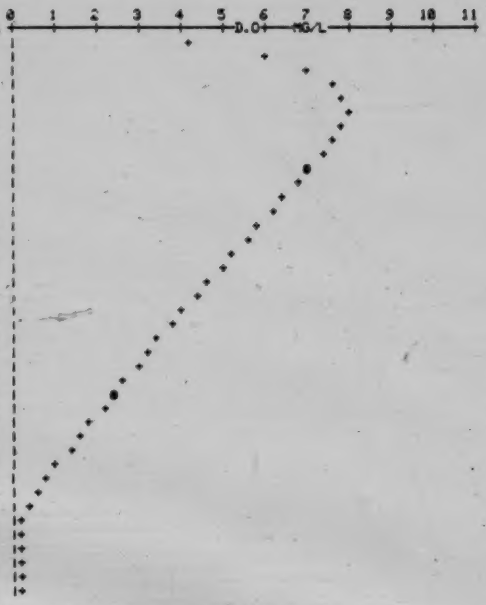
Listing of The Raw Data

```
GBT#17
180485
 1121833
 30
 4.1                                                Test Run
 30                                                 Informations
 45
 240
G.B 96-HR CONTINUES SAMPLE @ SEC#4 1ST PASS.
 7,402
 52,572
 92,668
 136,738
 181,758
 227,771                            Time & DO
 277,744                           Data points
 317,744
 362,734
 407,714
 452,694
 502,674
 542,654
 587,634
 631,614
 677,594
 721,564
 772,544
       .
       .
       .
       .
       .
       .
       .
       .
       .
       .
       .
       .
       .
       .
999,999
 15,742
 247,751                         Time & Temperature
 487,764                              Data Points
 729,774
 967,797
 1208,807
 1449,813
 1687,823
999.999
```

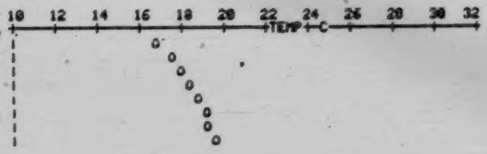
Section C2.

Printout of The "BA.PRINTOUT" Program.

```
     *********** THIS IS THE DATA COLLECTED
     *********** UNDER THE FILE NAME.          GBT#17 50
COMMENT :

G.B 96-HR CONTINUES SAMPLE @ SEC#4 1ST PASS.

             THIS TEST WAS CONDUCTED ON THE, 19/04/85

             THE TEST STARTED AT  (HR MIN),  14:04

             TOTAL TESTING TIME WAS, (MIN)    30

             SAMPLE WAS AERATED FOR, (MIN)   4.1

             SAMPLE WAS MIXED FOR,   (MIN)    30


             D.O READINGS WERE TAKEN EVERY (SEC)    45

              TEMP READINGS WERE TAKEN EVERY (SEC)   240


      TIME          D.O

  SEC     MIN       MG/L
       7      .11    4.17
      52      .86    5.87
      92     1.53    6.97
     136     2.26    7.47
     181     3.01    7.77
     227     3.78    7.87
     277     4.61    7.77
     316     5.26    7.57
     362     6.03    7.27
     407     6.78    6.97
     452     7.53    6.67
     502     8.36    6.27
     541     9.01    6.07
     586     9.76    5.77
     632    10.53    5.47
     677    11.28    5.17
     722    12.03    4.87
     772    12.86    4.57
     812    13.53    4.27
     856    14.26    3.97
     902    15.03    3.67
     947    15.78    3.37
     997    16.61    3.07
    1037    17.28    2.87
    1082    18.03    2.57
    1126    18.76    2.27
    1171    19.51    2.07
    1222    20.36    1.77
    1262    21.03    1.47
    1307    21.78    1.27
    1352    22.53     .97
    1396    23.26     .70
    1441    24.01     .40
    1492    24.86     .20
    1532    25.53     .10
    1576    26.26     .10
    1621    27.01     .10
    1666    27.76     .10
    1717    28.61     .10
    1757    29.28     .10
```

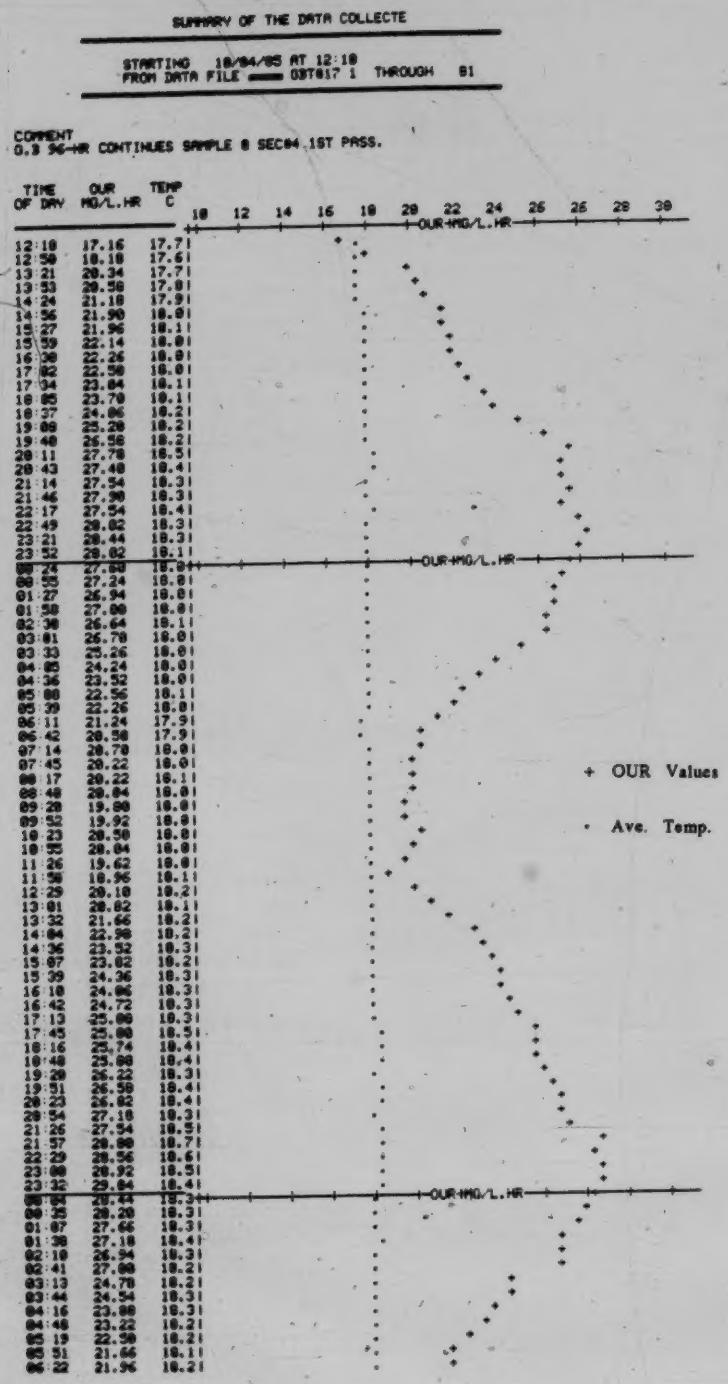


```
 ____________________ OUR = .392 MG/L.MIN________ 23.52 MG/L.HR

      TIME          TEMP
  SEC     MIN         C
      15      .25   16.70
     247     4.11   17.30
     487     8.11   17.90
     729    12.14   18.20
     967    16.11   18.50
    1207    20.11   19.00
    1449    24.14   19.10
    1687    28.11   19.40
```

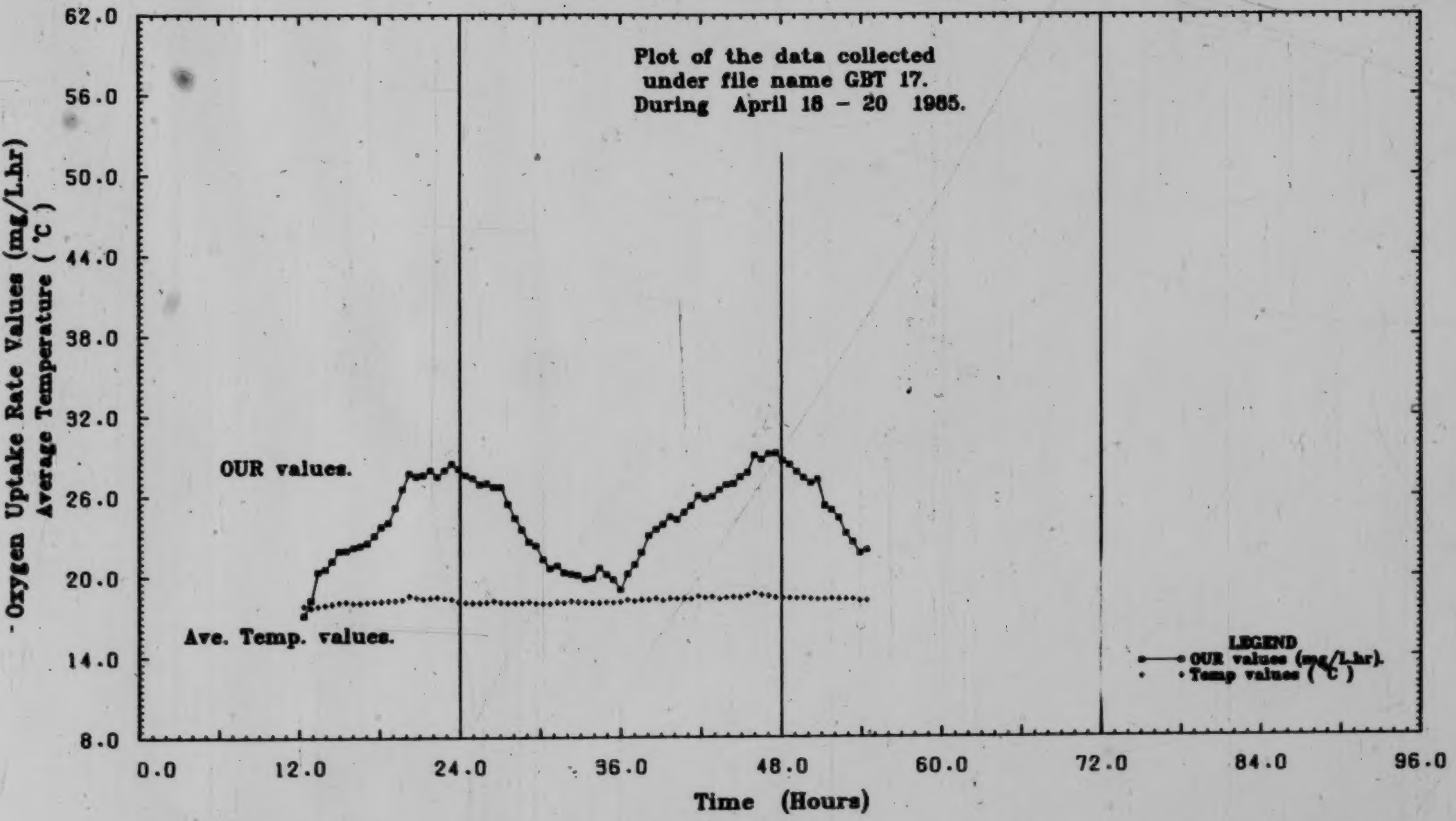


Section C3.

Printout of The "BA.SUMMARY" Program.



```
                SUMMARY OF THE DATA COLLECTE
           ____________________________________________
              STARTING    10/04/85 AT 12:18
              FROM DATA FILE ---- 03T017 1   THROUGH    81
           ____________________________________________

COMMENT
0.3 96-HR CONTINUES SAMPLE 0 SEC04 1ST PASS.

 TIME    OUR       TEMP
OF DAY  MG/L.HR     C
____________________________
12:18    17.16     17.7|
12:50    18.18     17.6|
13:21    20.34     17.7|
13:53    20.56     17.8|
14:24    21.18     17.9|
14:56    21.90     18.0|
15:27    21.96     18.1|
15:59    22.14     18.0|
16:30    22.26     18.0|
17:02    22.50     18.0|
17:34    23.04     18.1|
18:05    23.78     18.1|
18:37    24.06     18.2|
19:08    25.28     18.2|
19:40    26.56     18.2|
20:11    27.78     18.5|
20:43    27.48     18.4|
21:14    27.54     18.3|
21:46    27.90     18.3|
22:17    27.54     18.4|
22:49    28.02     18.3|
23:21    28.44     18.3|
23:52    28.02     18.1|
00:24    27.80     18.0|
00:55    27.24     18.0|
01:27    26.94     18.0|
01:58    27.00     18.0|
02:30    26.64     18.1|
03:01    26.78     18.0|
03:33    25.26     18.0|
04:05    24.24     18.0|
04:36    23.52     18.0|
05:08    22.56     18.1|
05:39    22.26     18.0|
06:11    21.24     17.9|
06:42    20.50     17.9|
07:14    20.78     18.0|
07:45    20.22     18.0|
08:17    20.22     18.1|
08:48    20.04     18.0|
09:20    19.80     18.0|
09:52    19.92     18.0|
10:23    20.50     18.0|
10:55    20.04     18.0|
11:26    19.62     18.0|
11:58    18.96     18.1|
12:29    20.18     18.2|
13:01    20.82     18.1|
13:32    21.66     18.2|
14:04    22.90     18.2|
14:36    23.52     18.3|
15:07    23.02     18.2|
15:39    24.36     18.3|
16:10    24.06     18.3|
16:42    24.72     18.3|
17:13    25.00     18.3|
17:45    25.80     18.5|
18:16    25.74     18.4|
18:48    25.88     18.4|
19:20    26.22     18.3|
19:51    26.58     18.4|
20:23    26.82     18.4|
20:54    27.18     18.3|
21:26    27.54     18.5|
21:57    28.00     18.7|
22:29    28.56     18.6|
23:00    28.92     18.5|
23:32    29.04     18.4|
00:04    28.44     18.3|
00:35    28.20     18.3|
01:07    27.66     18.3|
01:38    27.18     18.4|
02:10    26.94     18.3|
02:41    27.00     18.2|
03:13    24.78     18.2|
03:44    24.54     18.3|
04:16    23.88     18.3|
04:48    23.22     18.2|
05:19    22.50     18.2|
05:51    21.66     18.1|
06:22    21.96     18.2|
```



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

Section C4.

Printout of The "OUR.PLOT" Program.

APPENDIX D. Listing of The Software Questionnaire.

The specific opeation instructions required by the programs are interactively given to the programs. A listing of the questionnaire through which the programs are instructed is given in the following order.

Section	**Program Questionnaire**
D1.	OUR.OPERATION
D2.	BA.PRINTOUT
D3.	BA.SUMMARY
D4.	DTD.CONDENSER

By operating each of these programs the corresponding questions are listed on the PET computer screen one by one, in the same order as they are listed here. Answer to each question has to be typed, and then entered into the computer by pressing the RETURN key before the program can continue to the next question.

Section D1.

Listing of The "OUR.OPERATION" Program Questionnaire
Both in Short and Detail Versions.

The common portion of the detail & short vesions.

Will the required information be given
on the screen or read from a data file ?

What is the date today?
Give the information as day/month/year.
i.e. 9/Jan/85 as 090185. ?

Time of the day in 24-hr clock ?
i.e. for 1:45 pm. type 134500 ?

Any comments for future reference ?

Do you want to calibrate
the DO meter on the apparatus ?

IF you want to calibrate the meter,
the calibration mode can be entered.

Do you want
the questions in short or detail ?

The detailed version of the questionnaire:	**The short version of the questionnaire:**
NOTE: Activated sludge will automatically be pumped into the sampler. The aeration and mixing of the sample will also start automatically and continue as long as required. DO and Temp readings will start as soon as the sampler is full. Collected data are stored as long as you require.	
How many minutes will it take to fill the sampler ?	Time to fill the sampler .... min ?
How many minutes do you want to aerate the sample ?	Aeration time .... min ?
How many minutes do you want to monitor the sample (Total test time)?	Total test time ...... min ?
How many minutes do you want to mix the sample ?	Mixing time .... min ?
How frequently, in seconds, do want the DO readings ?	DO readings every .... sec ?
How frequently, in seconds, do you want Temp readings ?	Temp readings every .. sec ?

The commen portion of the short & detail versions.

What do you want to do for the next run ?
1) Continue with the same data.
2) Change the data.
3) Stop the program.
Type in the appropriate number ?

If number 1 is typed ....
The next question is asked,
otherwise continue to the proceeding questions.

How many times should the
test be run with the same data ?

Under what file name do you
want the data stored ?

Which disk drive is
the data disk in ?

NOTE: for continuous run the first
disk has to be in drive #0.

How many data files do you
want to store on the first disk ?

Have you calibrated the DO meter
for temperature and pressure ?

IF you want to calibrate the meter,
the calibration mode can be entered.
Refer to Appendix F.

A summary of the input information
will then be given.

Do you want to
change the input informations Y/N ?

If a change is necessary
the program will go back to the data input section.
If not the operation will begin.

Section D2.

Questionnaire listing of the "BA.PRINTOUT" Programs.

```
Do you want to look at
the disk directory Y/N?

How many continuous runs
do you want the data for?

Was the data stored under
1. Different file names ?
2. String of file names ?
Type the appropriate number?

Under what file name
is the data stored?

Note that the first disk drive
has to be in drive #0.
Which disk drive is the data disk under?

How many of the data files
are on the first disk?

Summary of the Input Information

Data is stored under. . . . . ---
The disk is in drive. . . . . . -

Do you want to change Y/N?
```

Section D3.

Questionnaire listing of the "BA.SUMMARY" program.

```
Do you want to look at
the disk drive directory Y/N?

Under what file string name
is the data stored?

How many continuous runs
do you want the data for?

Note that the first disk drive
has to be under drive #0.
Which disk drive is the data disk in?

How many files are there
on the first disk drive?

Summary of the Input Information

**Data is stored under the file name ----.
**There will be -- data files read.
**The disk is in drive --.
**There are -- files on the first disk.

Do you want to change the input Y/N?
```

Section D4.

Questionnaire of the "DTD.CONDENCER" program.

Name of the file
which is to be condenced ?
In the case of string of files
only give the original, or main name.
. . . . ?

Number of files to be condenced ?

Which disk drive
is the data disk under ?

How many files are
there on the first disk ?

Are there any files
which has to be missed ?

If there are any files
Which have to be missed, the program
will require the name and number of them.

Under what file name
should the condence file be stored ?

Under which disk drive ?

If there are no changes
press any key to start the program.

The program will automatically
inform the the operator when all the files
on the avalable disk are read,
and the disk should be changed.

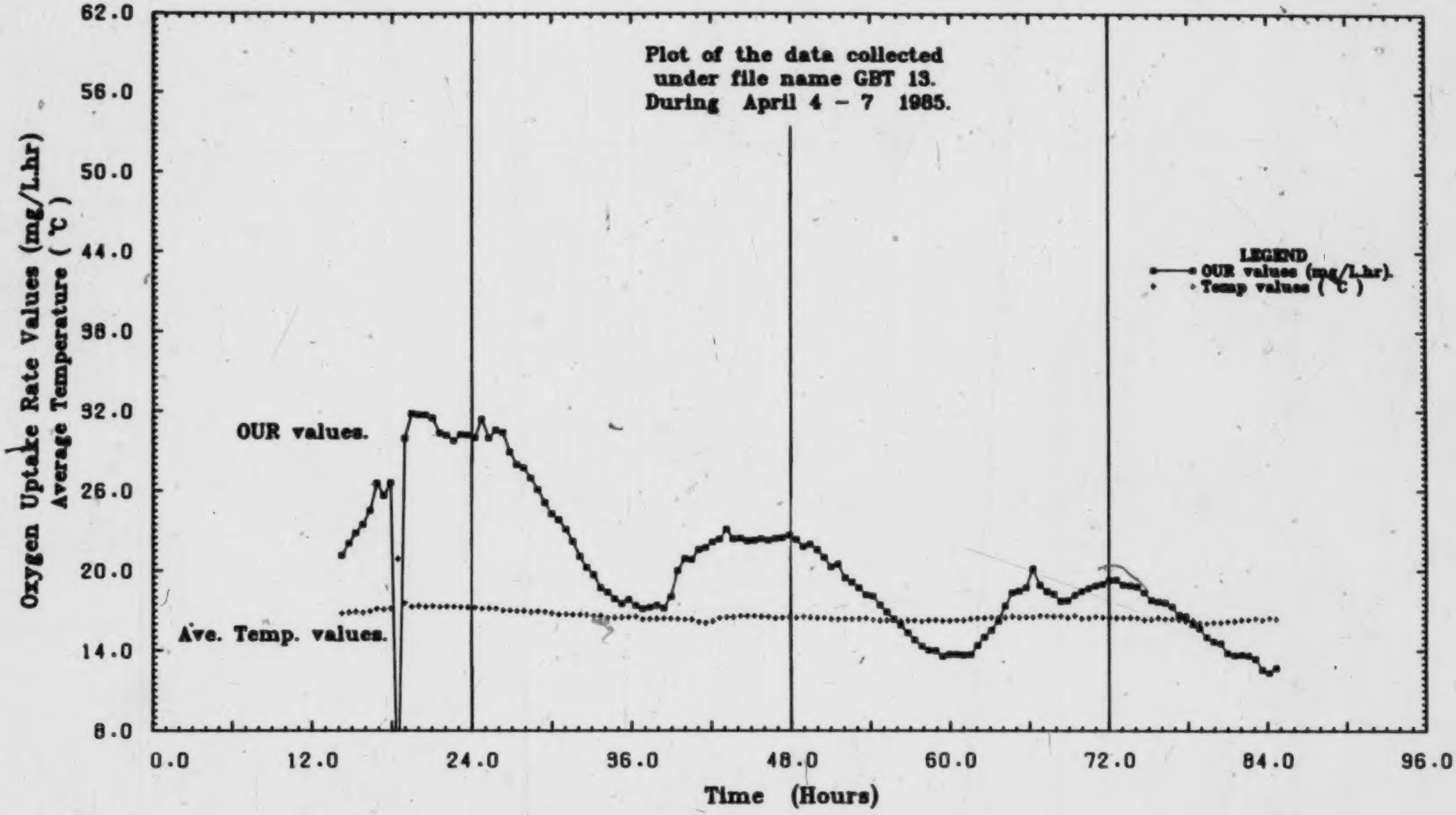
APPENDIX E. Listing of The Data.

Plot and tabulated listing of the data collected during the six months operation of the apparatus at the Edmonton Gold Bar sewage Treatment Plant, are given in this Appendix.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 4- 7 / 4 / 1985)

DAY 1 4 4 85			DAY 2 5 4 85			DAY 3 6 4 85			DAY 4 7 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:12	30.02	17.3	0:22	22.36	16.5	0: 1	19.33	16.5
			0:43	31.41	17.2	0:54	21.62	16.6	0:33	19.34	16.5
			1:15	30.00	17.2	1:25	22.00	16.5	1: 4	18.97	16.5
			1:46	30.59	17.2	1:57	21.57	16.5	1:36	18.92	16.5
			2:18	30.41	17.0	2:28	21.01	16.5	2: 7	18.63	16.5
			2:50	28.94	17.0	3: 0	20.30	16.4	2:39	18.40	16.3
			3:21	27.99	17.0	3:31	20.51	16.4	3:11	17.83	16.4
			3:52	27.75	17.0	4: 3	19.47	16.4	3:42	17.70	16.5
			4:25	26.97	16.9	4:34	19.16	16.4	4:14	17.62	16.4
			4:55	26.11	17.0	5: 6	18.72	16.4	4:45	17.32	16.4
			5:27	25.14	16.9	5:38	18.20	16.4	5:17	16.70	16.3
			5:58	24.29	16.8	6: 9	18.11	16.3	5:48	16.59	16.3
			6:30	23.64	16.7	6:41	17.44	16.3	6:20	16.02	16.3
			7: 2	23.13	16.6	7:12	16.91	16.3	6:51	15.69	16.1
			7:33	22.21	16.7	7:44	16.36	16.3	7:23	15.03	16.1
			8: 5	21.09	16.7	8:15	15.92	16.2	7:54	14.70	16.2
			8:36	20.27	16.7	8:47	15.35	16.3	8:26	14.66	16.1
			9: 8	19.72	16.6	9:18	14.80	16.2	8:57	13.82	16.2
			9:39	18.73	16.6	9:50	14.34	16.2	9:29	13.67	16.2
			10:11	18.40	16.5	10:21	14.03	16.3	10: 0	13.71	16.3
			10:42	17.91	16.5	10:53	14.00	16.3	10:32	13.66	16.4
			11:14	17.54	16.5	11:25	13.88	16.3	11: 4	13.40	16.4
			11:45	17.60	16.5	11:56	13.73	16.3	11:35	12.96	16.3
			12:17	17.42	16.5	12:28	13.72	16.3	12: 7	12.38	16.5
			12:48	17.16	16.4	13: 0	13.67	16.3	12:38	12.71	16.4
			13:20	17.27	16.4	13:31	13.70	16.4			
			13:51	17.43	16.4	14: 2	14.40	16.5			
			14:23	17.21	16.4	14:34	15.03	16.5			
14:12	21.17	16.6	14:55	18.07	16.4	15: 5	15.54	16.5			
14:44	22.09	16.9	15:26	20.03	16.4	15:37	16.24	16.5			
15:15	22.86	16.9	15:58	20.93	16.4	16: 8	17.36	16.5			
15:47	23.51	16.9	16:29	20.80	16.3	16:40	18.36	16.6			
16:18	24.54	17.0	17: 1	21.60	16.2	17:11	18.49	16.5			
16:50	25.55	17.2	17:32	21.75	16.1	17:43	18.75	16.5			
17:22	25.86	17.1	18: 4	22.16	16.2	18:14	20.15	16.5			
17:53	25.84	17.2	18:35	22.39	16.5	18:46	18.94	16.6			
18:25	1.73	20.9	19: 7	23.13	16.5	19:18	18.47	16.6			
18:56	28.88	17.6	19:38	22.41	16.5	19:50	18.26	16.6			
19:28	31.83	17.3	20:10	22.46	16.6	20:21	17.74	16.6			
20: 0	31.75	17.4	20:41	22.25	16.6	20:52	17.78	16.5			
20:31	31.72	17.3	21:13	22.29	16.6	21:26	18.20	16.5			
21: 2	31.48	17.4	21:44	22.41	16.6	21:55	18.47	16.4			
21:34	30.37	17.3	22:16	22.29	16.6	22:27	18.71	16.5			
22: 5	30.20	17.3	22:48	22.43	16.5	22:58	18.91	16.6			
22:37	29.79	17.3	23:19	22.49	16.5	23:30	19.03	16.5			
23: 8	30.25	17.3	23:51	22.66	16.5	0: 1	19.33	16.5			
23:40	30.22	17.3									

These data were collected under file GBT#13

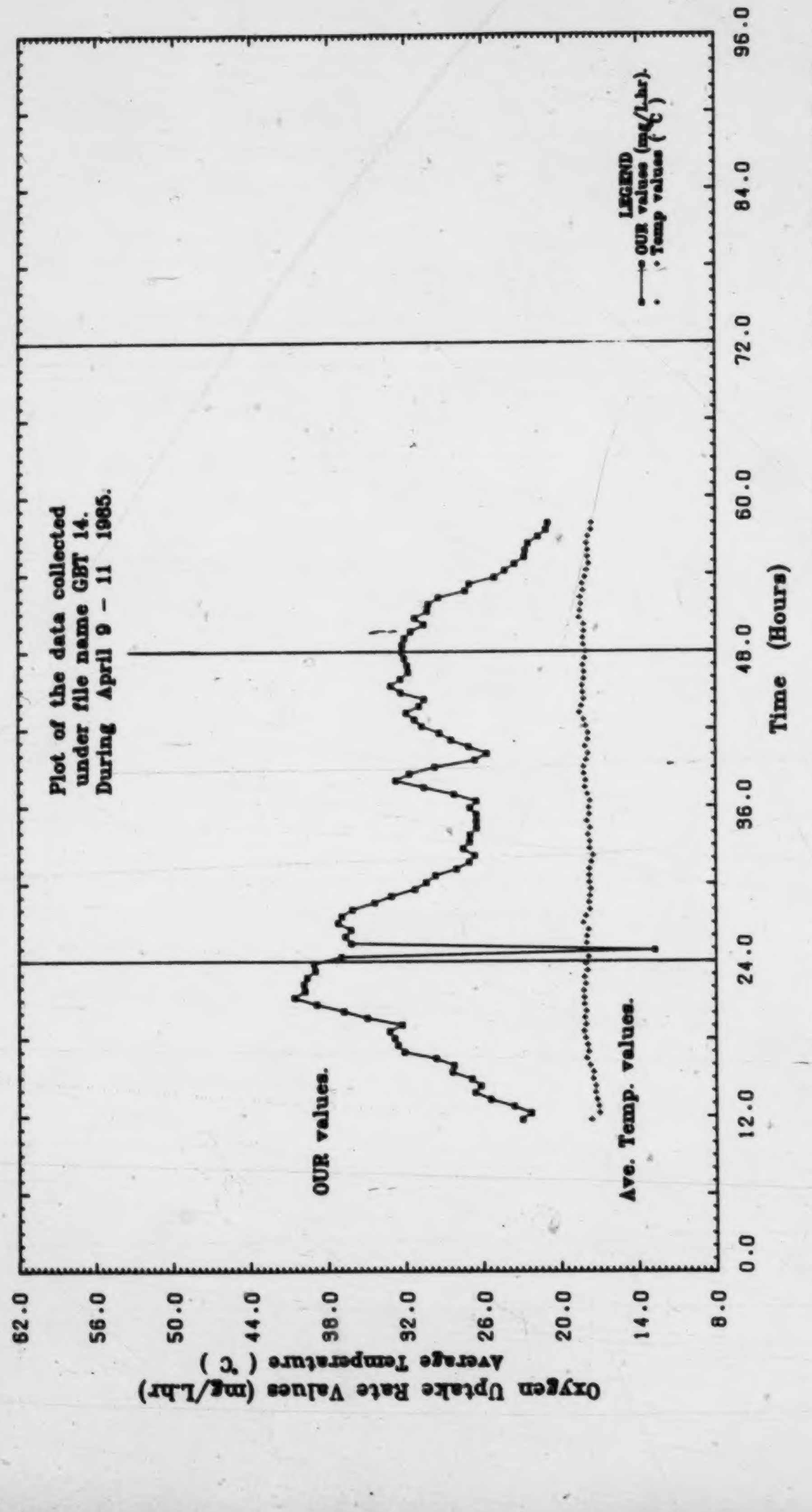


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 9-11 / 4 / 1988)

DAY 1			DAY 2			DAY 3		
9 4 88			10 4 88			11 4 88		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:19	38.84	17.8	0:29	32.20	18.2
			0:50	12.73	18.4	1: 1	32.03	18.2
			1:22	36.16	18.0	1:32	31.58	18.2
			1:53	38.81	18.0	2: 4	30.54	18.3
			2:25	36.20	17.9	2:35	31.28	18.5
			2:56	37.19	18.3	3: 7	30.26	18.5
			3:28	38.90	18.1	3:38	30.20	18.4
			4: 0	38.08	17.6	4:10	29.40	18.4
			4:31	34.37	17.6	4:41	27.33	18.2
			5: 2	33.07	17.6	5:13	27.02	18.3
			5:34	31.24	17.7	5:44	25.06	18.1
			6: 5	30.37	17.6	6:16	24.27	17.9
			6:37	28.57	17.6	6:47	23.51	17.8
			7: 8	26.04	17.6	7:19	22.76	17.9
			7:40	27.06	17.6	7:50	22.88	17.9
			8:11	26.83	17.5	8:22	22.46	17.9
			8:43	27.52	17.6	8:54	21.66	17.9
			9:15	27.03	17.7	9:25	21.06	17.8
			9:46	26.56	17.9	9:57	20.53	17.8
			10:18	26.47	17.7			
			10:50	26.48	18.0			
			11:21	25.49	17.8			
11:42	22.88	17.7	11:52	27.00	17.6			
12:13	22.33	17.1	12:25	26.49	17.7			
12:45	23.66	17.1	12:56	26.23	17.9			
13:16	25.48	17.3	13:27	30.54	18.1			
13:48	28.85	17.4	13:58	32.72	18.1			
14:19	28.22	17.3	14:30	31.87	18.2			
14:51	28.91	17.5	15: 1	29.70	18.2			
15:23	28.43	17.5	15:33	26.61	18.0			
15:54	28.29	17.6	16: 4	26.88	17.9			
16:26	29.68	18.0	16:36	27.08	18.1			
16:57	32.12	17.9	17: 7	28.44	17.9			
17:29	32.60	17.9	17:39	29.34	17.9			
18: 0	32.80	18.1	18:11	30.70	18.0			
18:32	33.26	18.2	18:42	31.28	18.2			
19: 3	32.28	18.1	19:14	31.91	18.5			
19:35	34.98	18.2	19:46	30.91	18.4			
20: 6	35.77	18.1	20:17	30.51	18.2			
20:38	38.67	18.2	20:48	32.31	18.3			
21: 9	40.60	18.2	21:20	33.08	18.3			
21:41	39.78	18.3	21:51	32.38	18.2			
22:12	39.86	18.1	22:23	31.76	18.2			
22:44	39.51	18.2	22:54	31.84	18.2			
23:16	38.98	18.0	23:26	32.08	18.1			
23:47	39.08	18.1	23:57	32.28	18.0			

These data were collected under file SBT#14



Plot of the data collected
under file name GBT 14.
During April 9 – 11 1985.

Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 11-14 / 4 / 1985)

DAY 1 11 4 85			DAY 2 12 4 85			DAY 3 13 4 85			DAY 4 14 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 1	23.54	15.8	0:11	24.92	17.4	0:22	17.66	16.8
			0:32	23.53	15.9	0:43	24.41	17.2	0:53	17.43	16.8
			1: 4	23.33	15.8	1:14	25.10	17.2	1:25	17.16	16.9
			1:35	23.39	15.8	1:46	25.14	17.2	1:56	16.77	16.8
			2: 7	22.61	15.8	2:17	24.16	17.3	2:28	16.56	16.9
			2:38	22.60	15.8	2:50	23.38	17.3	3: 0	16.30	16.7
			3:10	21.94	15.8	3:20	22.51	17.2	3:31	15.96	16.6
			3:42	21.36	15.7	3:52	22.30	17.3	4: 3	15.39	16.5
			4:13	20.66	15.7	4:23	21.33	17.2	4:34	14.85	16.6
			4:45	19.60	15.8	4:55	20.44	17.2	5: 6	14.30	16.5
			5:16	18.78	15.8	5:27	19.41	17.2	5:37	14.25	16.5
			5:48	18.05	15.7	5:58	18.70	17.1	6: 9	13.15	16.4
			6:19	17.37	15.8	6:30	18.25	17.0	6:40	12.92	16.2
			6:51	16.84	15.8	7: 1	18.12	17.0	7:12	12.46	16.2
			7:22	16.54	15.7	7:33	17.89	17.0	7:43	12.26	16.3
			7:54	16.59	15.7	8: 4	17.16	17.1	8:15	12.11	16.3
			8:25	17.08	15.8	8:36	16.65	17.2	8:46	11.62	16.2
			8:57	16.88	15.7	9: 7	16.49	17.1	9:18	11.12	16.1
			9:28	17.09	15.9	9:39	15.62	17.2	9:50	10.95	16.0
			10: 0	16.46	16.0	10:10	15.66	17.2	10:21	10.56	15.9
			10:32	16.24	16.0	10:42	15.52	17.3	10:52	10.88	16.0
			11: 3	16.35	16.1	11:13	15.39	17.2	11:25	10.69	16.0
			11:35	17.13	16.4	11:45	15.37	17.2	11:56	10.53	16.1
			12: 6	17.13	16.4	12:16	15.22	17.3	12:27	10.38	16.0
			12:38	17.11	16.4	12:48	15.46	17.3	13: 0	10.61	16.1
			13: 9	18.82	16.6	13:20	15.77	17.2	13:30	10.82	16.3
13:30	21.66	16.7	13:41	20.11	16.6	13:51	16.26	17.3	14: 2	10.97	16.3
14: 2	20.71	16.3	14:12	21.08	16.7	14:23	17.12	17.4	14:33	11.16	16.3
14:33	19.86	16.2	14:44	22.27	16.7	14:54	16.75	17.3	15: 5	11.20	16.2
15: 5	19.74	16.1	15:15	22.54	17.0	15:26	17.33	17.1	15:36	12.14	16.3
15:36	19.57	15.9	15:47	22.34	17.0	15:57	17.79	17.3	16: 8	12.77	16.2
16: 8	20.26	16.1	16:18	22.27	17.0	16:29	18.33	17.2	16:39	13.52	16.4
16:39	20.62	16.1	16:50	22.83	17.1	17: 0	18.53	17.2	17:11	13.89	16.4
17:11	20.67	16.0	17:21	23.00	17.3	17:32	18.76	17.2	17:42	14.12	16.3
17:42	21.89	16.0	17:53	23.19	17.3	18: 3	18.82	17.2	18:14	14.20	16.2
18:14	24.09	16.0	18:25	24.08	17.3	18:35	18.36	17.3	18:45	14.16	16.3
18:45	24.53	16.0	18:56	25.04	17.4	19: 6	18.37	17.2	19:17	14.63	16.6
19:17	24.35	15.9	19:28	25.66	17.4	19:38	18.52	17.3	19:50	15.13	16.7
19:50	24.34	16.0	20: 0	25.56	17.4	20:10	18.73	17.3	20:20	15.13	16.8
20:20	24.72	15.9	20:31	25.66	17.3	20:41	19.03	17.3	20:52	14.96	16.9
20:52	23.57	16.0	21: 2	25.68	17.5	21:13	18.75	17.4	21:23	15.39	16.9
21:23	23.60	15.9	21:34	27.48	17.4	21:44	18.86	17.4	71:55	15.50	16.9
21:55	23.04	16.0	22: 5	27.30	17.3	22:16	18.62	17.2	22:26	15.32	16.7
22:26	23.07	15.9	22:37	26.24	17.4	22:47	18.75	17.1	22:58	15.52	16.7
22:58	23.06	15.9	23: 8	25.67	17.3	23:19	18.28	17.1	23:29	15.60	16.6
23:29	23.30	16.0	23:40	25.38	17.2	23:50	18.20	16.8	0: 1	15.98	16.6

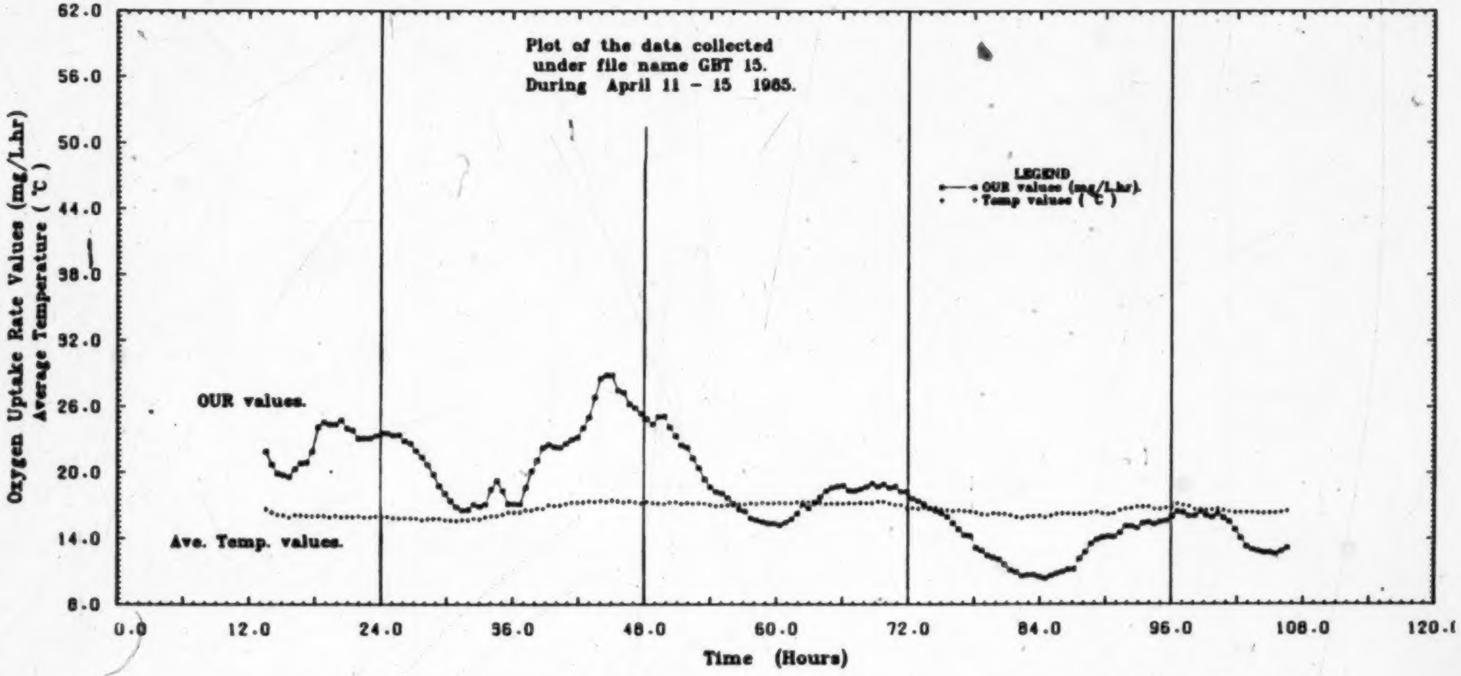
These data were collected under file SBT#15

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 15 / 4 / 1985)

DAY 5 15 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0: 1	15.99	16.8
0:32	16.45	17.2
1: 4	16.39	17.1
1:35	16.05	17.0
2: 7	16.06	16.7
2:38	16.47	16.7
3:10	16.12	16.6
3:42	15.85	16.7
4:13	16.25	16.6
4:45	15.86	16.6
5:16	15.54	16.5
5:48	14.83	16.4
6:19	14.08	16.4
6:51	13.30	16.4
7:22	13.01	16.4
7:54	12.88	16.4
8:25	12.73	16.3
8:57	12.75	16.4
9:28	12.60	16.4
10: 0	12.85	16.4
10:32	13.15	16.6

These data were collected under file GBT#15



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

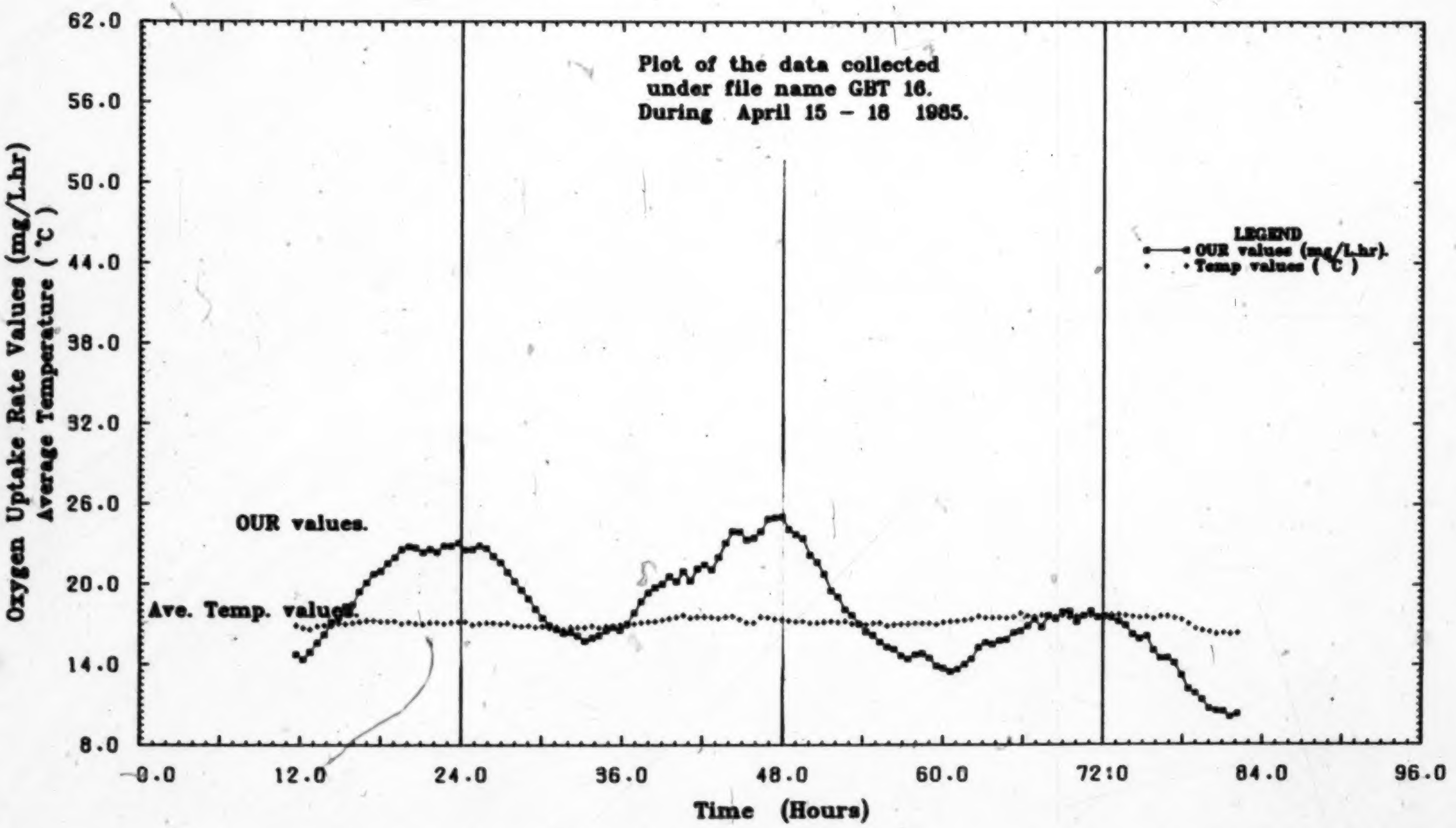
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 15-18 / 4 / 1985)

DAY 1 15 4 85			DAY 2 16 4 85			DAY 3 17 4 85			DAY 4 18 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:16	22.57	17.2	0:26	24.14	17.3	0: 5	17.65	17.7
			0:48	22.59	17.0	0:58	23.78	17.3	0:37	17.54	17.8
			1:19	22.66	17.1	1:29	23.47	17.3	1: 8	17.25	17.8
			1:51	22.68	17.1	2: 1	22.22	17.2	1:40	16.95	17.7
			2:22	22.09	17.1	2:33	21.67	17.2	2:12	16.29	17.6
			2:54	21.63	17.0	3: 4	20.61	17.2	2:43	15.95	17.5
			3:25	20.90	17.1	3:36	19.58	17.3	3:15	16.15	17.6
			3:57	20.22	16.9	4: 7	19.10	17.3	3:46	15.10	17.5
			4:28	19.57	16.9	4:38	18.15	17.3	4:18	14.50	17.6
			5: 0	18.92	16.9	5:10	17.72	17.1	4:50	14.52	17.6
			5:31	18.15	16.8	5:42	17.06	17.2	5:21	14.13	17.5
			6: 3	17.49	16.9	6:13	16.50	17.0	5:53	13.21	17.4
			6:34	16.94	16.7	6:45	16.23	17.1	6:25	12.17	17.1
			7: 6	16.66	16.6	7:16	15.72	17.2	6:56	11.68	16.7
			7:37	16.36	16.7	7:48	15.35	16.9	7:27	11.37	16.6
			8: 9	16.44	16.8	8:19	15.18	17.0	8: 0	10.71	16.5
			8:40	16.16	16.8	8:51	14.70	17.1	8:30	10.54	16.3
			9:12	15.77	16.8	9:22	14.44	17.1	9: 2	10.49	16.4
			9:44	16.01	16.9	9:54	14.77	17.1	9:33	10.09	16.3
			10:15	16.19	16.8	10:26	14.66	17.1	10: 5	10.30	16.4
			10:47	16.57	16.9	10:57	14.53	17.1			
			11:18	16.62	17.0	11:29	13.81	17.0			
11:39	14.70	16.9	11:50	16.59	17.0	12: 0	13.74	17.2			
12:11	14.36	16.7	12:21	17.06	16.9	12:32	13.46	17.3			
12:42	14.82	16.6	12:53	17.90	17.1	13: 3	13.67	17.3			
13:14	15.62	16.6	13:25	18.74	17.2	13:35	14.04	17.4			
13:45	16.21	16.9	13:56	19.40	17.2	14: 6	14.45	17.4			
14:17	17.15	16.9	14:27	19.78	17.3	14:38	15.30	17.6			
14:50	17.48	17.1	15: 0	20.06	17.4	15: 9	15.68	17.5			
15:20	18.34	17.0	15:30	20.61	17.5	15:41	15.54	17.5			
15:52	18.45	17.1	16: 2	20.25	17.6	16:12	15.61	17.6			
16:23	19.43	17.2	16:33	20.59	17.7	16:44	15.90	17.5			
16:55	20.10	17.3	17: 5	20.29	17.8	17:16	16.41	17.6			
17:26	20.74	17.3	17:36	21.19	17.8	17:47	16.54	17.8			
17:58	20.95	17.2	18: 8	21.61	17.8	18:19	16.90	17.7			
18:29	21.55	17.2	18:40	21.13	17.8	18:50	17.42	17.6			
19: 1	21.99	17.2	19:11	22.07	17.5	19:22	16.81	17.7			
19:32	22.55	17.1	19:43	22.12	17.6	19:53	17.57	17.6			
20: 4	22.60	17.2	20:14	23.55	17.7	20:25	17.43	17.6			
20:35	22.71	17.0	20:46	23.95	17.4	20:56	17.34	17.7			
21: 7	22.36	17.0	21:17	23.36	17.2	21:28	18.00	17.8			
21:38	22.50	17.1	21:50	23.50	17.2	22: 0	17.21	17.8			
22:10	22.40	17.2	22:20	23.99	17.6	22:31	17.68	17.8			
22:41	22.85	17.1	22:52	24.52	17.6	23: 3	18.02	17.7			
23:13	22.85	17.1	23:23	25.01	17.4	23:34	17.57	17.8			
23:45	23.07	17.2	23:55	25.06	17.4	0: 5	17.65	17.7			

These data were collected under file 68T#15



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 18-20 / 4 / 1985)

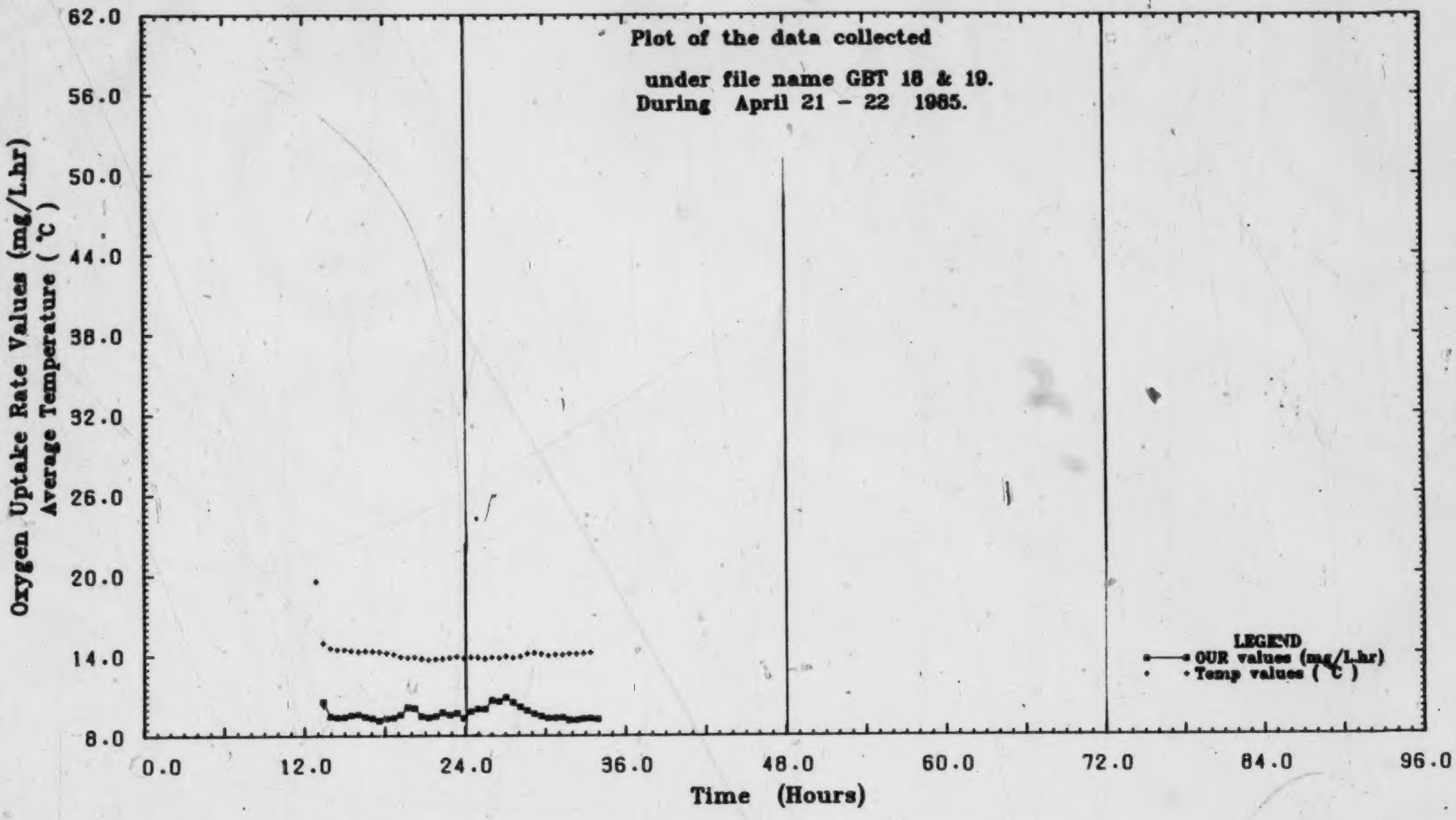
DAY 1 18 4 85			DAY 2 19 4 85			DAY 3 20 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:23	27.82	18.1	0: 3	28.87	18.4
			0:54	27.39	18.1	0:34	28.37	18.4
			1:26	26.93	18.1	1: 5	27.85	18.4
			1:57	27.01	18.1	1:37	27.40	18.4
			2:29	26.72	18.2	2: 8	27.01	18.4
			3: 0	26.72	18.1	2:40	27.27	18.3
			3:32	25.46	18.1	3:12	25.29	18.3
			4: 4	24.40	18.1	3:43	24.98	18.4
			4:35	23.55	18.1	4:15	24.39	18.3
			5: 7	22.63	18.2	4:47	23.26	18.3
			5:38	22.34	18.0	5:18	22.59	18.4
			6:10	21.32	18.0	5:50	21.76	18.2
			6:41	20.65	18.0	6:21	21.98	18.2
			7:13	20.85	18.1			
			7:44	20.33	18.1			
			8:16	20.22	18.2			
			8:47	20.13	18.1			
			9:19	19.85	18.1			
			9:51	19.93	18.1			
			10:22	20.69	18.1			
			10:54	20.19	18.1			
			11:25	19.81	18.1			
			11:57	19.07	18.2			
			12:28	20.24	18.3			
12:17	17.14	17.6	13: 0	20.92	18.2			
12:50	18.26	17.7	13:31	21.62	18.3			
13:20	20.26	17.8	14: 3	23.11	18.3			
13:52	20.59	17.8	14:35	23.55	18.4			
14:23	21.21	18.0	15: 6	23.93	18.3			
14:55	21.88	18.1	15:38	24.49	18.4			
15:26	21.97	18.2	16: 9	24.29	18.4			
15:58	22.20	18.1	16:41	24.82	18.4			
16:29	22.32	18.1	17:12	25.30	18.4			
17: 1	22.94	18.1	17:44	26.07	18.6			
17:33	23.10	18.2	18:15	25.62	18.5			
18: 4	23.75	18.2	18:47	26.00	18.5			
18:36	24.07	18.3	19:19	26.50	18.4			
19: 7	25.18	18.3	19:50	26.86	18.5			
19:39	26.60	18.3	20:22	26.97	18.5			
20:10	27.78	18.5	20:53	27.46	18.4			
20:42	27.52	18.5	21:25	27.79	18.6			
21:13	27.82	18.4	21:56	28.08	18.6			
21:45	27.89	18.4	22:28	28.76	18.7			
22:16	27.50	18.5	23: 0	29.19	18.6			
22:48	27.99	18.4	23:31	29.24	18.4			
23:20	28.48	18.4	0: 3	28.87	18.4			
23:51	28.10	18.2	0:34	28.37	18.4			

These data were collected under file GBT#17

The Results of The Automated
Oxygen Uptake Rate Apparatus
(For the period of 21-22 / 4 / 1985)

DAY 1 21 4 85			DAY 2 22 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:22	9.82	13.9
			0:53	10.02	13.9
			1:25	10.00	13.8
			1:56	10.66	13.9
			2:28	10.58	13.8
			3: 0	10.88	14.0
			3:31	10.50	13.8
			4: 3	10.16	13.9
			4:34	9.89	14.1
			5: 6	9.65	14.2
			5:37	9.46	14.1
			6: 9	9.31	14.0
			6:40	3.35	14.1
			7:12	9.39	14.1
			7:43	9.19	14.1
			8:15	9.19	14.1
			8:46	9.28	14.2
			9:18	9.30	14.2
			9:50	9.25	14.2
			10:53	10.25	14.6
			11:25	9.93	14.5
			11:56	10.29	14.4
12:48	2.08	15.8	12:27	10.96	14.5
13:19	10.58	15.0	13: 0	11.90	14.5
13:51	9.47	14.8	13:30	12.96	14.6
14:22	9.40	14.5	14: 2	13.86	14.5
14:54	9.42	14.5	14:33	14.41	14.6
15:25	9.56	14.4	15: 5	13.71	14.6
15:57	9.52	14.3	15:36	12.59	14.7
16:28	9.44	14.4	16: 8	11.92	14.6
17: 0	9.33	14.3	16:40	11.82	14.7
17:31	9.14	14.3	17:11	11.58	14.6
18: 3	9.32	14.2	17:43	11.47	14.6
18:35	9.37	14.1	18:14	11.20	14.6
19: 6	9.59	13.9	18:46	11.33	14.5
19:38	10.14	13.9	19:17	12.11	14.6
20: 9	10.07	13.8	19:50	12.54	14.6
20:41	9.46	13.8	20:20	12.32	14.6
21:12	9.36	13.7	20:52	11.86	14.6
21:44	9.47	13.7			
22:15	9.74	13.8			
22:47	9.57	13.9			
23:18	9.70	13.9			
23:50	6.32	13.6			

These data were collected under file GBT#18 GBT#19

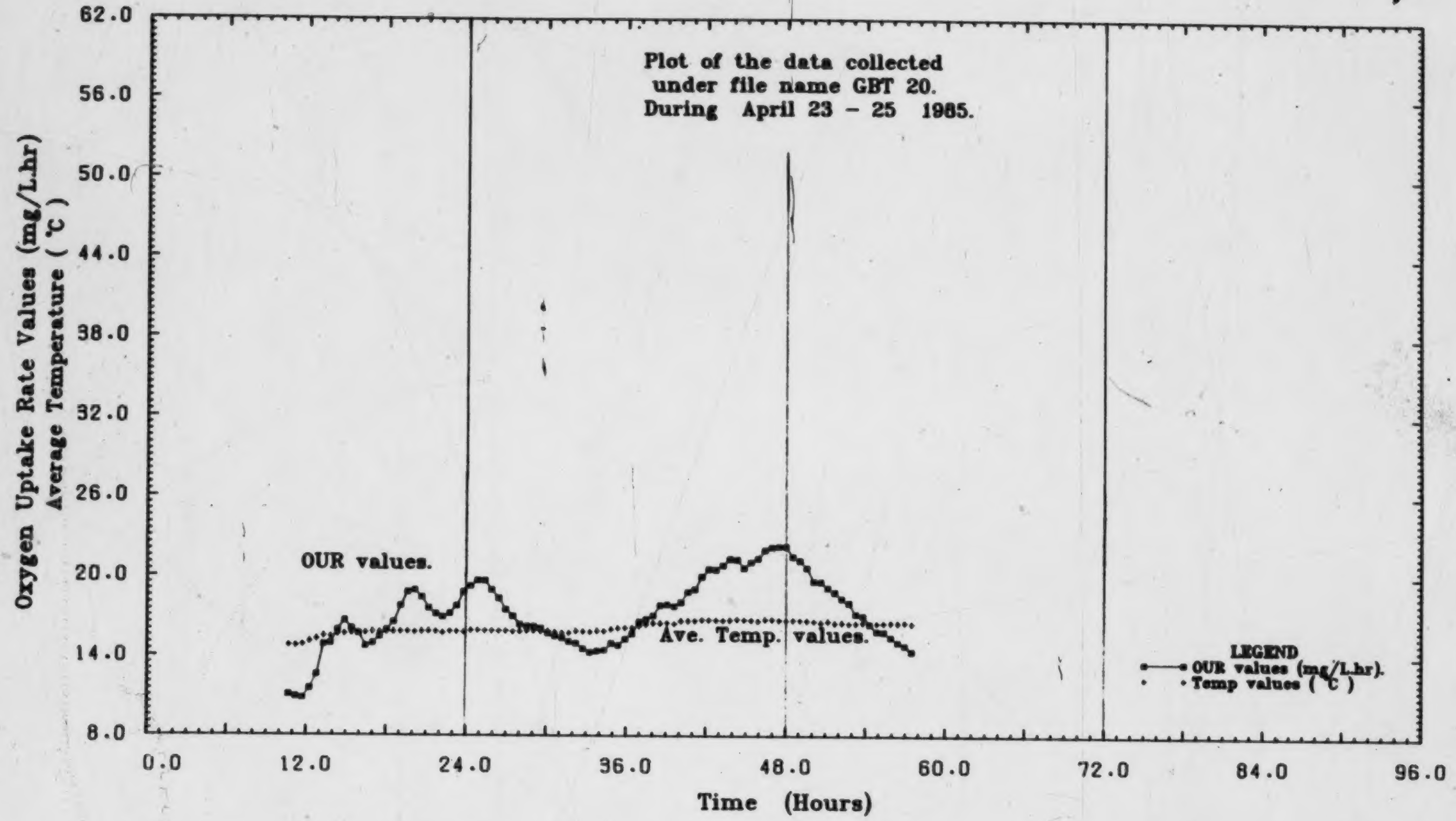


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 23-25 / 4 / 1985)

DAY 1 23 4 85			DAY 2 24 4 85			DAY 3 25 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:18	19.27	15.9	0:29	21.52	16.7
			0:50	19.09	15.9	1: 1	21.23	16.7
			1:21	18.88	15.9	1:32	20.87	16.7
			1:52	18.58	15.9	2: 4	19.96	16.7
			2:25	18.35	15.9	2:35	19.64	16.6
			2:55	17.50	15.9	3: 7	19.17	16.7
			3:27	17.01	15.9	3:38	18.63	16.6
			3:58	16.39	15.9	4:10	18.35	16.6
			4:30	16.25	15.9	4:42	18.02	16.6
			5: 1	16.23	15.9	5:13	17.19	16.6
			5:33	16.10	15.9	5:45	17.09	16.6
			6: 5	15.72	15.9	6:16	16.44	16.6
			6:36	15.61	15.8	6:48	15.98	16.6
			7: 8	15.36	15.8	7:19	15.63	16.6
			7:39	15.10	15.8	7:51	15.44	16.6
			8:11	14.97	15.9	8:23	15.06	16.6
			8:42	14.57	15.9	8:54	14.83	16.6
			9:14	14.29	15.8	9:25	14.39	16.6
			9:45	14.40	15.9			
			10:17	14.47	15.9			
10:37	11.09	14.8	10:50	14.58	16.0			
11: 9	10.94	14.8	11:20	14.82	16.1			
11:40	10.85	14.9	11:52	15.29	16.2			
12:12	11.58	15.1	12:23	15.71	16.2			
12:43	12.80	15.3	12:55	16.60	16.3			
13:15	14.88	15.5	13:26	16.79	16.4			
13:46	14.95	15.5	13:58	17.06	16.5			
14:18	15.96	15.6	14:30	17.64	16.5			
14:50	16.57	15.7	15: 1	17.90	16.5			
15:21	16.06	15.7	15:33	17.77	16.5			
15:53	15.71	15.8	16: 4	18.06	16.7			
16:25	14.78	15.8	16:36	18.85	16.7			
16:56	14.97	15.9	17: 7	19.05	16.7			
17:27	15.46	15.8	17:39	20.01	16.8			
18: 0	15.97	15.8	18:10	20.59	16.8			
18:30	16.56	15.8	18:42	20.54	16.8			
19: 2	17.79	15.8	19:14	20.87	16.7			
19:34	18.63	15.9	19:45	21.35	16.7			
20: 5	18.97	15.8	20:17	21.30	16.8			
20:37	18.42	15.9	20:48	20.87	16.8			
21: 8	17.80	15.9	21:20	21.11	16.7			
21:40	17.17	15.8	21:51	21.39	16.7			
22:11	16.95	15.7	22:23	22.02	16.8			
22:43	17.20	15.9	22:54	22.23	16.8			
23:14	17.77	15.9	23:26	22.29	16.7			
23:46	18.82	15.8	23:58	22.26	16.7			

These data were collected under file GBT#20



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 25-28 / 4 / 1985)

DAY 1 25 4 85			DAY 2 26 4 85			DAY 3 27 4 85			DAY 4 28 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:28	18.70	17.0	0: 8	21.38	17.5	0:20	19.26	17.3
			1: 0	18.79	17.0	0:40	20.99	17.3	0:52	19.50	17.3
			1:31	18.61	16.9	1:11	20.78	17.3	1:23	19.47	17.3
			2: 3	18.86	16.9	1:43	20.33	17.3	1:55	18.42	17.3
			2:34	18.69	16.9	2:14	20.01	17.3	2:26	17.81	17.3
			3: 6	18.63	16.9	2:46	19.55	17.3	2:58	17.21	17.3
			3:38	18.16	16.9	3:18	19.28	17.3	3:29	16.52	17.2
			4: 9	17.62	16.9	3:50	18.84	17.3	4: 1	16.11	17.2
			4:41	17.05	16.9	4:21	18.38	17.2	4:33	15.71	17.3
			5:12	16.20	16.9	4:52	17.82	17.3	5: 4	15.50	17.3
			5:44	15.85	16.7	5:25	17.45	17.2	5:36	15.36	17.3
			6:15	15.51	16.8	5:55	16.80	17.3	6: 7	15.31	17.3
			6:47	15.59	16.7	6:27	16.34	17.1	6:39	15.06	17.2
			7:18	15.56	16.6	6:58	16.18	17.2	7:10	14.59	17.2
			7:50	15.31	16.6	7:30	15.89	17.3	7:42	14.36	17.3
			8:22	14.87	16.6	8: 2	15.17	17.2	8:14	13.86	17.1
			8:53	14.26	16.7	8:33	14.90	17.2	8:45	13.45	17.2
			9:25	14.30	16.6	9: 5	14.81	17.1	9:17	13.11	17.2
			9:56	16.69	16.7	9:36	14.58	17.3	9:48	12.62	17.1
			10:28	18.22	16.7	10: 8	14.11	17.3	10:20	12.64	17.2
10:48	14.62	16.6	11: 0	18.19	16.7	10:39	13.86	17.2	10:51	12.53	17.2
11:20	14.62	16.6	11:31	17.79	16.7	11:11	13.76	17.3	11:23	12.27	17.2
11:51	14.50	16.4	12: 2	1.85	20.9	11:43	13.23	17.2	11:55	12.30	17.1
12:23	14.49	16.5	12:34	17.79	17.2	12:14	13.18	17.1	12:26	12.36	17.3
12:54	14.83	16.5	13: 6	17.46	16.9	12:46	13.09	17.1	12:58	12.27	17.2
13:26	15.72	16.5	13:37	18.24	16.9	13:17	13.28	17.1	13:29	12.32	17.3
13:57	16.56	16.6	14: 9	18.86	16.9	13:50	13.54	17.1	14: 1	12.28	17.3
14:29	17.27	16.7	14:40	18.78	17.0	14:20	14.07	17.3	14:32	12.43	17.3
15: 0	17.80	16.8	15:12	19.45	16.9	14:52	14.97	17.2	15: 4	12.80	17.3
15:32	18.55	16.8	15:43	20.43	17.0	15:23	15.26	17.2	15:35	13.40	17.2
16: 4	19.35	16.7	16:15	20.70	17.0	15:55	16.17	17.2	16: 7	13.80	17.3
16:35	19.76	16.8	16:46	20.80	17.1	16:27	16.87	17.3	16:38	14.11	17.4
17: 7	19.04	16.8	17:18	20.80	17.2	16:58	16.75	17.4	17:10	14.37	17.3
17:38	18.81	16.7	17:50	20.88	17.2	17:30	16.97	17.3	17:41	14.91	17.4
18:10	18.32	16.7	18:21	21.39	17.2	18: 1	17.45	17.3	18:13	14.88	17.4
18:41	17.99	16.7	18:53	21.88	17.2	18:33	17.18	17.2	18:45	15.02	17.2
19:13	18.27	16.8	19:25	22.71	17.3	19: 4	17.01	17.3	19:16	15.16	17.2
19:44	18.44	16.7	19:56	23.65	17.3	19:36	16.82	17.2	19:48	15.38	17.2
20:16	18.97	16.8	20:27	23.11	17.3	20: 8	16.90	17.4	20:19	15.49	17.3
20:47	19.55	16.7	21: 0	22.54	17.3	20:39	17.33	17.2	20:51	15.77	17.2
21:19	19.81	16.8	21:31	22.30	17.4	21:11	17.52	17.3	21:22	15.79	17.3
21:51	19.80	16.8	22: 2	21.89	17.3	21:42	17.68	17.4	21:54	15.76	17.2
22:22	18.95	16.9	22:34	22.27	17.3	22:14	17.77	17.3	22:25	15.87	17.2
22:54	18.42	16.9	23: 5	22.29	17.3	22:45	18.65	17.4	22:57	15.78	17.1
23:25	18.41	17.0	23:37	21.72	17.4	23:17	18.68	17.3	23:28	16.49	17.2
23:57	18.61	16.9				23:48	19.10	17.3			

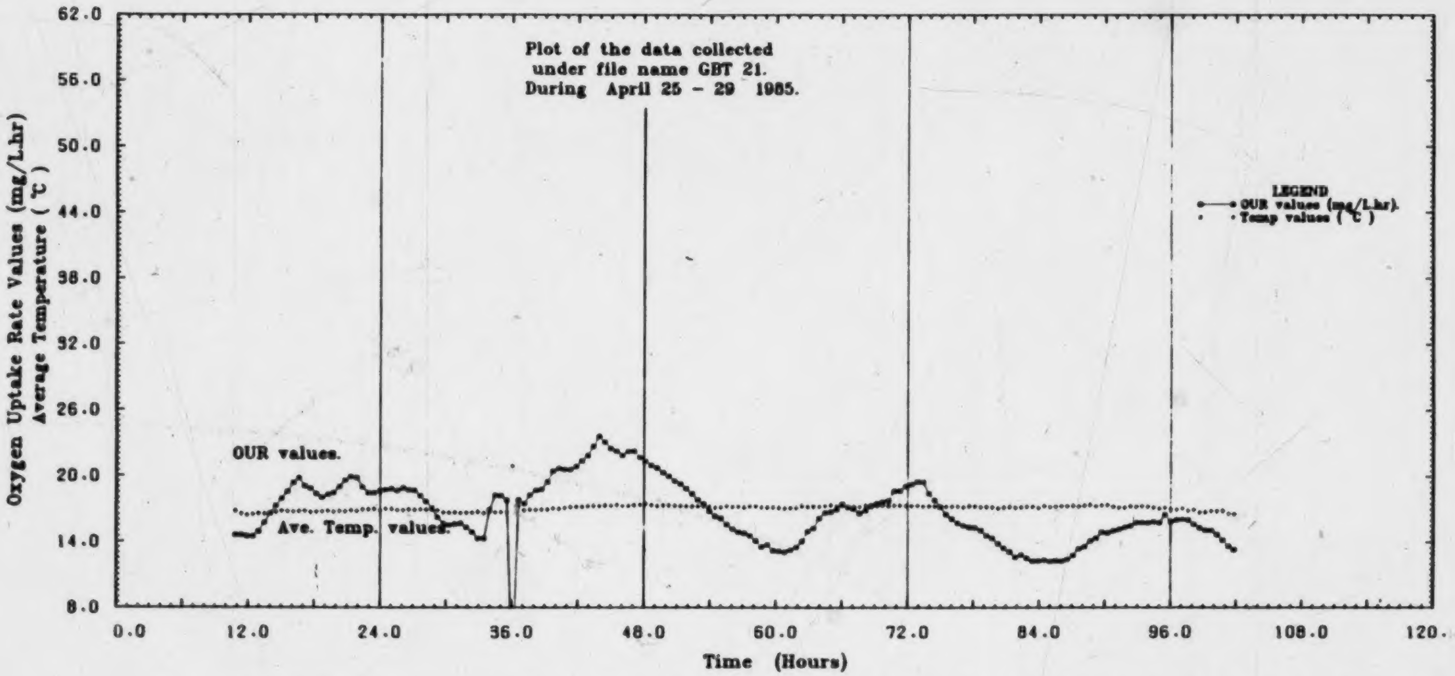
These data were collected under file GBT#21

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 29 / 4 / 1985)

DAY 5 29 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0: 0	15.88	17.0
0:32	16.03	17.0
1: 3	16.08	17.1
1:35	16.02	16.9
2: 6	15.84	17.0
2:38	15.31	16.7
3: 9	15.11	16.7
3:41	15.09	16.8
4:12	14.71	16.8
4:44	14.20	16.8
5:16	13.65	16.6
5:47	13.31	16.6

These data were collected under file GBT#21



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

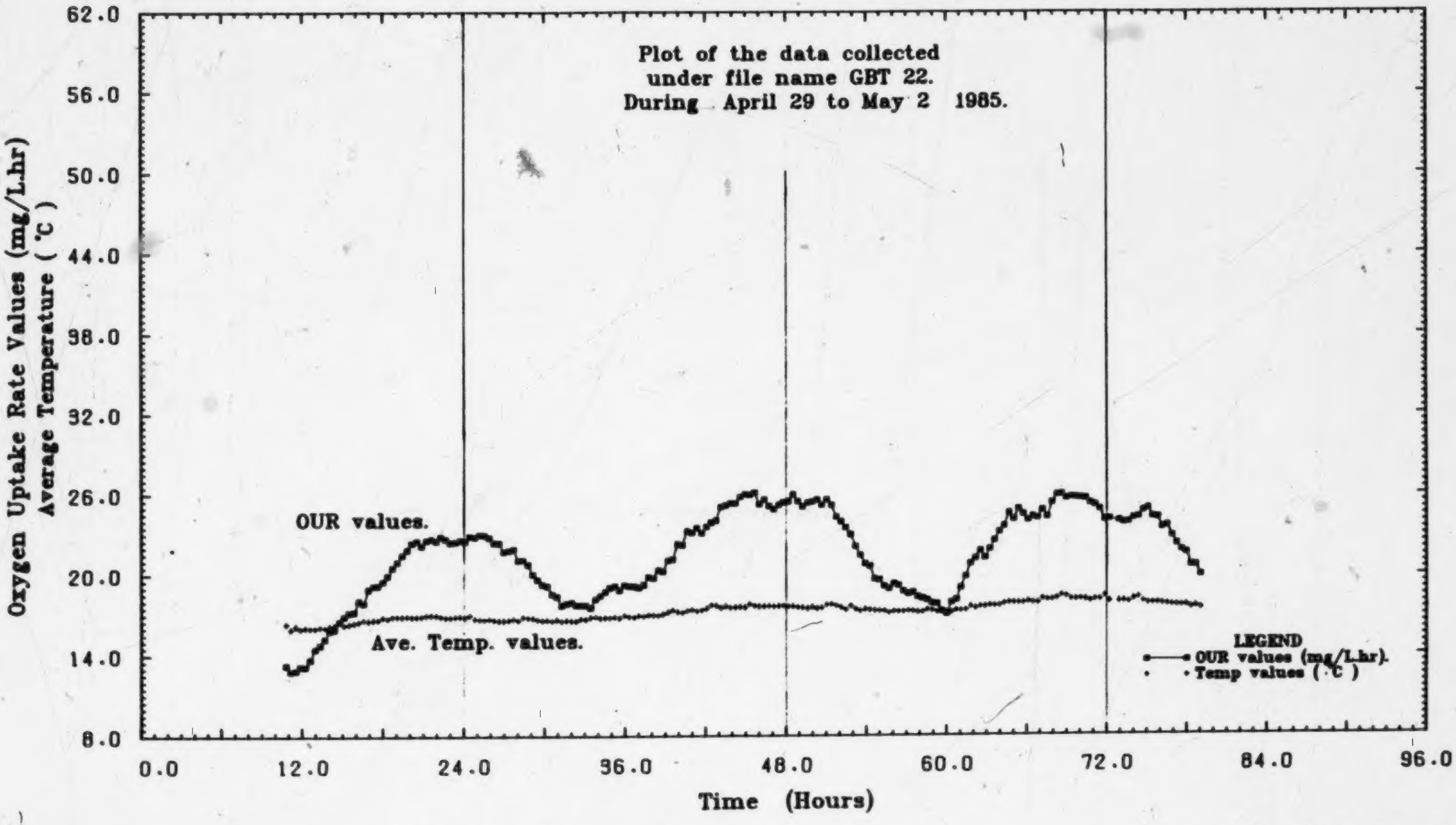
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of April 28 to May 2 1985)

DAY 1 28 4 85			DAY 2 30 4 85			DAY 3 1 5 85			DAY 4 2 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 4	22.54	16.9	0: 8	25.51	17.7	0:11	24.17	18.0
			0:25	22.92	17.0	0:29	26.02	17.7	0:54	24.06	18.0
			0:47	22.87	16.8	0:51	25.51	17.8	1:16	23.92	18.0
			1: 9	23.04	16.7	1:12	26.13	17.6	1:37	23.98	18.0
			1:30	23.01	16.7	1:34	25.41	17.5	2: 0	24.25	18.2
			1:52	22.82	16.7	1:55	25.49	17.8	2:21	24.32	18.3
			2:13	22.43	16.7	2:17	25.64	17.5	2:42	24.60	18.0
			2:35	22.42	16.6	2:38	25.23	17.6	3: 4	24.98	17.9
			2:56	21.76	16.6	3: 0	25.63	17.8	3:25	24.34	17.9
			3:18	21.86	16.7	3:22	25.21	17.6	3:47	24.28	17.9
			3:39	21.96	16.6	3:43	24.36	17.7	4: 8	23.58	17.8
			4: 1	21.12	16.8	4: 5	24.01	17.6	4:30	23.69	17.8
			4:22	21.13	16.8	4:26	23.55	17.4	4:52	22.92	17.7
			4:44	20.81	16.6	4:48	23.05	17.7	5:13	22.32	17.7
			5: 5	20.06	16.6	5:10	22.15	17.5	5:35	21.85	17.7
			5:27	19.67	16.7	5:31	21.51	17.3	5:56	21.67	17.7
			5:50	19.30	16.6	5:53	20.86	17.5	6:18	20.73	17.5
			6:10	19.19	16.7	6:14	20.67	17.4	6:39	20.71	17.6
			6:32	18.56	16.6	6:36	19.71	17.4	7: 1	20.00	17.5
			6:53	18.41	16.7	6:57	19.66	17.3			
			7:15	17.74	16.6	7:19	19.16	17.3			
			7:36	17.89	16.6	7:40	18.97	17.2			
			7:58	17.97	16.6	8: 2	19.36	17.3			
			8:19	17.77	16.6	8:23	19.22	17.3			
			8:41	17.76	16.7	8:45	18.79	17.3			
			9: 2	17.76	16.7	9: 7	18.60	17.3			
			9:25	17.56	16.9	9:28	18.71	17.3			
			9:46	18.22	16.9	9:50	18.37	17.2			
			10: 7	18.47	16.8	10:11	18.26	17.2			
10:47	13.32	16.4	10:29	18.79	16.6	10:33	18.13	17.4			
11: 8	12.67	16.0	10:50	19.06	16.6	10:54	17.89	17.4			
11:30	12.94	16.2	11:12	19.16	16.9	11:15	17.83	17.2			
11:51	13.24	16.0	11:33	18.89	16.8	11:37	17.30	17.2			
12:13	13.21	16.1	11:55	19.26	17.0	12: 0	17.08	17.3			
12:34	13.74	16.1	12:16	19.16	16.9	12:20	17.95	17.2			
12:55	14.52	16.1	12:38	19.17	16.9	12:42	18.15	17.4			
13:16	14.60	16.1	13: 0	19.06	17.0	13: 3	19.06	17.4			
13:38	15.26	16.1	13:21	19.26	16.9	13:25	19.86	17.4			
14: 1	15.68	16.2	13:43	19.69	17.1	13:46	20.88	17.6			
14:22	15.96	16.3	14: 4	19.79	17.0	14: 8	21.24	17.5			
14:44	16.56	16.5	14:26	20.40	17.0	14:30	21.81	17.6			
15: 5	16.93	16.3	14:47	20.29	17.1	14:51	21.29	17.6			
15:27	17.21	16.4	15: 9	21.13	17.2	15:13	21.93	17.7			
15:50	17.26	16.4	15:30	21.20	17.4	15:34	22.56	17.7			
16:10	18.10	16.5	15:52	22.35	17.3	15:56	23.23	17.7			
16:32	17.93	16.7	16:13	22.26	17.2	16:17	23.65	17.9			
16:53	18.94	16.6	16:35	23.32	17.4	16:39	24.62	17.9			
17:15	19.19	16.7	16:56	23.20	17.4	17: 0	24.16	17.9			
17:38	19.22	16.7	17:18	23.55	17.3	17:22	24.92	17.9			
17:58	19.53	16.9	17:40	23.17	17.4	17:43	24.53	17.9			
18:19	19.96	16.8	18: 1	23.65	17.5	18: 5	24.09	18.0			
18:41	20.57	16.9	18:23	23.96	17.6	18:26	24.36	17.8			
19: 2	20.89	16.9	18:44	24.11	17.6	18:48	24.26	17.9			
19:25	21.51	16.9	19: 6	25.10	17.6	19: 9	24.63	18.2			
19:46	21.91	16.9	19:27	25.22	17.7	19:31	24.33	18.1			
20: 7	22.41	16.9	19:50	25.36	17.6	19:53	25.40	18.1			
20:28	22.57	16.9	20:11	25.38	17.6	20:14	25.86	18.3			
20:50	22.21	16.9	20:32	25.84	17.6	20:36	26.02	18.5			
21:12	22.61	17.0	20:54	26.04	17.6	20:57	25.72	18.4			
21:33	22.72	17.0	21:15	26.01	17.9	21:19	26.61	18.2			
21:55	22.97	17.0	21:37	26.16	17.7	21:40	25.78	18.2			
22:16	22.86	16.9	21:58	25.30	17.7	22: 2	25.75	18.2			
22:38	22.72	16.9	22:20	25.65	17.7	22:25	25.70	18.1			
23: 0	22.47	16.9	22:42	25.16	17.7	22:45	25.36	18.0			
23:21	22.50	16.9	23: 3	24.92	17.7	23: 7	25.20	18.2			
23:42	22.63	16.9	23:25	25.25	17.7	23:28	24.90	18.1			

These data were collected under file CST#22

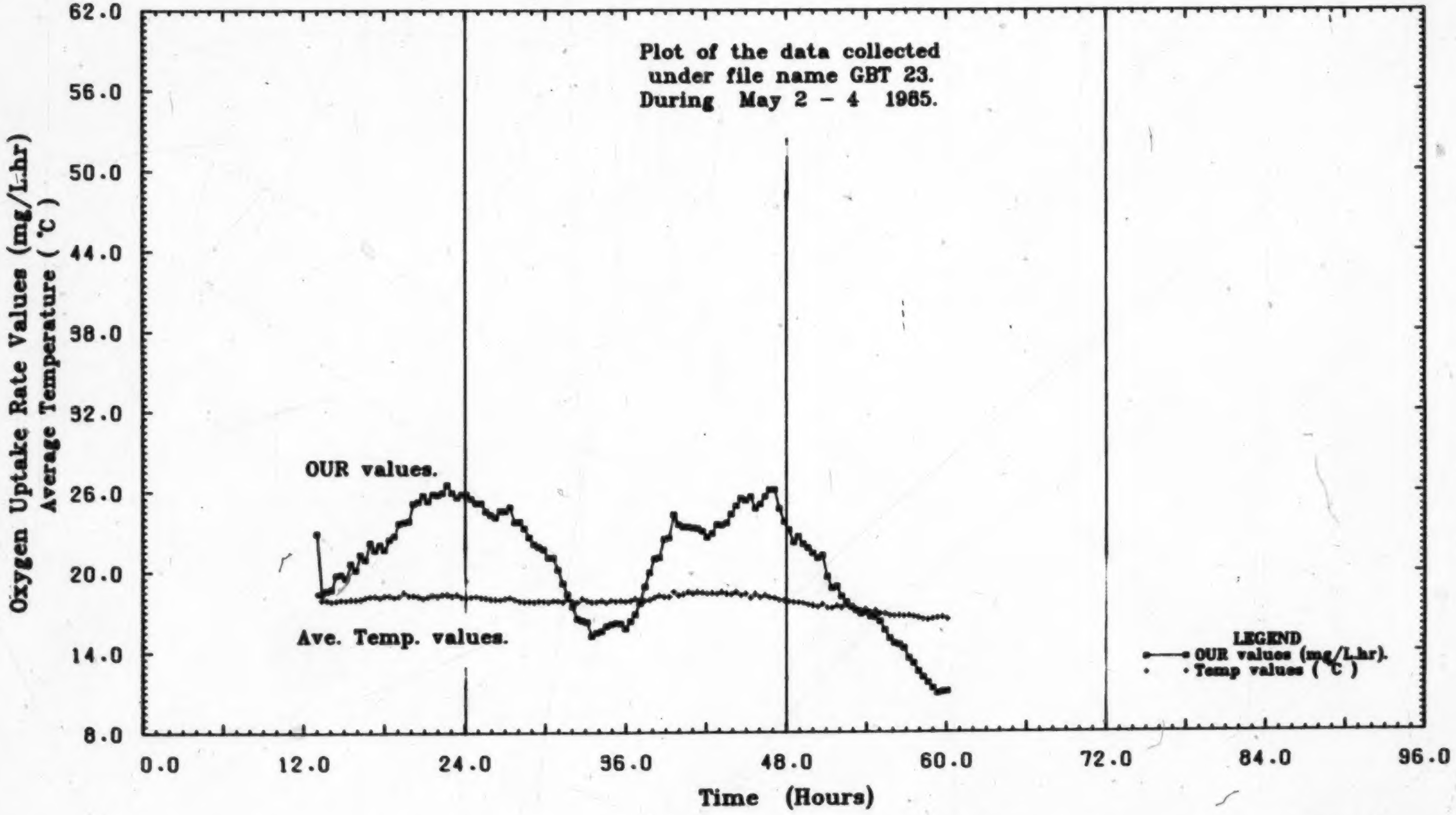


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 2- 4 / 5 / 1985)

DAY 1 2 5 85			DAY 2 3 5 85			DAY 3 4 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 5	25.88	18.2	0: 9	23.20	17.9
			0:26	25.53	18.2	0:31	22.29	17.8
			0:48	25.21	18.3	0:52	22.70	17.8
			1:10	25.20	18.2	1:14	22.14	17.7
			1:31	24.98	18.1	1:36	21.85	17.8
			1:53	24.32	18.0	1:57	21.45	17.5
			2:14	24.12	18.0	2:19	21.09	17.4
			2:36	24.60	18.0	2:40	21.27	17.6
			2:57	24.61	18.1	3: 2	19.70	17.4
			3:19	24.69	18.2	3:23	18.85	17.3
			3:40	23.78	18.0	3:45	18.98	17.5
			4: 2	23.80	17.9	4: 6	18.23	17.4
			4:23	23.32	17.8	4:28	17.75	17.6
			4:45	22.85	17.9	4:50	17.42	17.4
			5: 7	22.13	17.8	5:11	17.15	17.2
			5:28	21.94	17.9	5:33	16.90	17.1
			5:50	21.75	17.9	5:54	17.00	17.3
			6:11	21.13	17.8	6:16	16.89	17.0
			6:33	21.11	17.9	6:38	16.64	17.2
			6:54	20.22	17.9	7: 0	16.32	16.9
			7:16	19.20	17.8	7:21	15.86	16.9
			7:37	18.37	18.0	7:43	15.07	16.8
			8: 0	17.46	17.8	8: 4	14.89	16.7
			8:21	16.55	17.8	8:26	14.59	16.8
			8:42	16.41	18.0	8:47	14.32	16.7
			9: 4	16.28	17.9	9: 9	13.57	16.8
			9:25	15.24	17.8	9:30	13.19	16.7
			9:47	15.49	17.8	9:52	12.58	16.6
			10: 9	15.80	17.9	10:13	12.16	16.5
			10:30	15.94	17.8	10:35	11.78	16.5
			10:52	16.12	17.9	10:57	11.33	16.5
			11:13	16.22	17.8	11:18	10.85	[illegible]
			11:35	16.16	17.9	11:40	11.07	16.6
			11:56	15.80	17.8	12: 2	11.10	16.5
			12:18	16.34	17.9			
12:57	22.90	18.4	12:39	16.86	18.0			
13:18	18.41	17.9	13: 1	17.70	17.9			
13:40	18.53	17.9	13:23	18.95	17.9			
14: 1	18.73	17.8	13:44	20.02	18.0			
14:23	19.80	17.9	14: 6	21.05	18.2			
14:44	19.85	18.0	14:27	21.14	18.3			
15: 6	19.57	17.9	14:50	22.53	18.2			
15:27	20.67	18.0	15:11	22.83	18.2			
15:50	20.19	18.0	15:32	24.35	18.6			
16:11	21.34	18.0	15:54	23.63	18.3			
16:32	20.98	18.2	16:15	23.44	18.4			
16:54	22.22	18.2	16:37	23.44	18.6			
17:15	21.88	18.3	16:58	23.38	18.4			
17:37	22.08	18.1	17:19	23.32	18.5			
17:58	21.72	18.3	17:41	23.11	18.5			
18:20	22.46	18.3	18: 2	22.65	18.4			
18:41	22.78	18.2	18:25	22.84	18.5			
19: 3	23.68	18.3	18:46	23.61	18.4			
19:25	23.77	18.5	19: 7	23.57	18.5			
19:46	23.85	18.3	19:29	23.73	18.4			
20: 7	25.16	18.3	19:50	24.38	18.4			
20:29	25.30	18.2	20:12	25.01	18.6			
20:51	25.78	18.1	20:34	25.98	18.3			
21:12	25.38	18.2	20:55	25.41	18.4			
21:34	25.88	18.3	21:17	25.89	18.1			
21:55	25.61	18.2	21:38	24.80	18.4			
22:17	25.98	18.4	22: 0	25.12	18.2			
22:38	26.88	18.4	22:22	25.88	18.3			
23: 0	25.97	18.3	22:43	26.20	18.2			
23:22	25.82	18.4	23: 5	26.21	18.1			
23:43	25.88	18.2	23:26	24.80	18.0			

These data were collected under file GBT#23



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

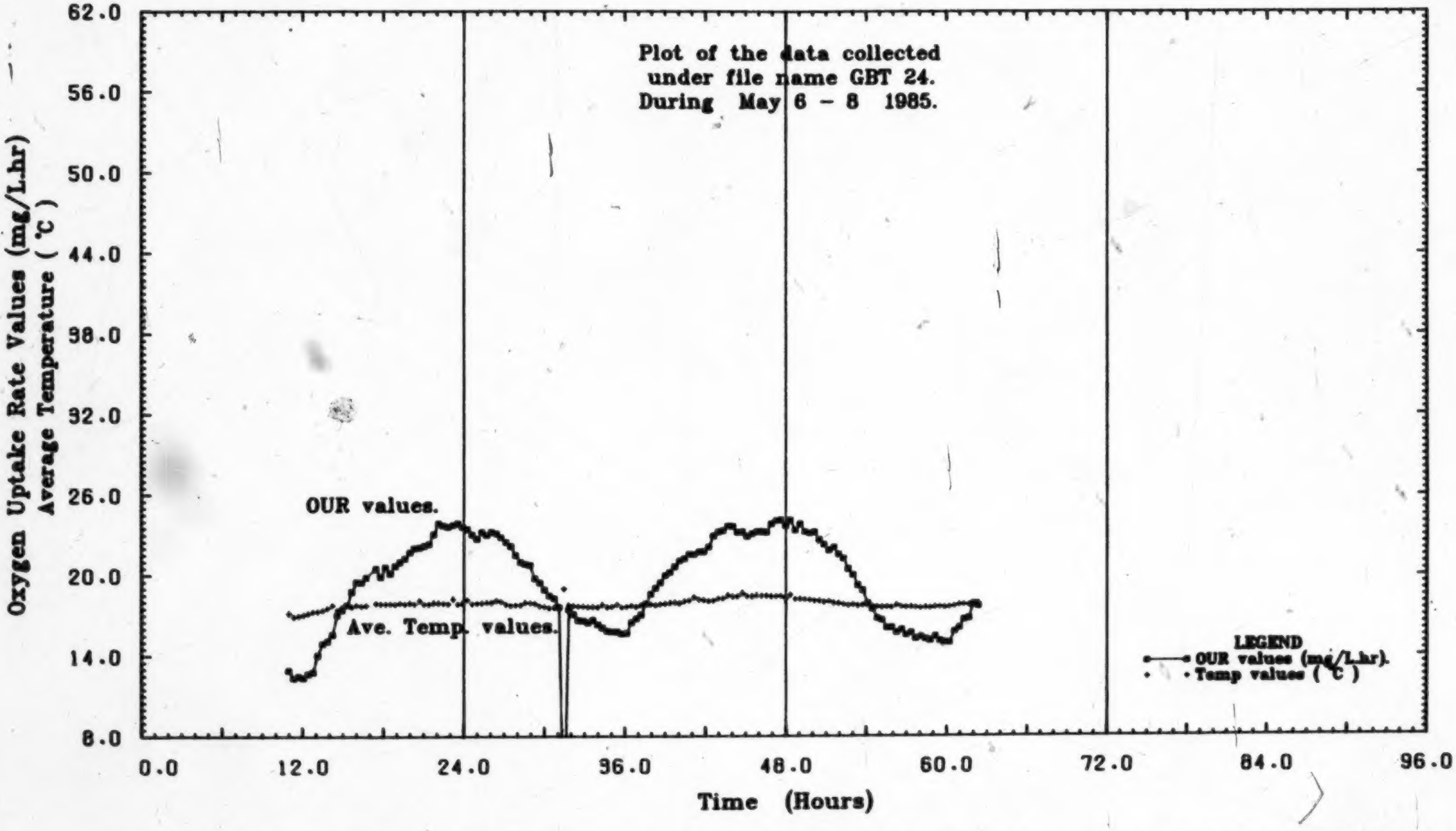
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 6- 8 / 5 / 1985)

DAY 1 6 5 85			DAY 2 7 5 85			DAY 3 8 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:14	23.47	18.2	0:19	24.14	18.6
			0:36	23.05	17.9	0:41	23.40	18.3
			0:58	22.74	18.0	1: 3	23.88	18.3
			1:19	23.25	18.0	1:25	23.29	18.3
			1:41	23.03	18.0	1:46	23.20	18.2
			2: 2	23.26	18.0	2: 7	23.26	18.2
			2:25	23.14	18.2	2:29	22.89	18.1
			2:45	22.88	18.1	2:50	22.33	18.1
			3: 7	22.50	17.9	3:12	21.91	18.1
			3:28	22.19	17.8	3:34	22.13	18.0
			3:50	21.54	17.8	3:55	21.61	18.0
			4:12	21.01	17.8	4:17	21.30	17.9
			4:33	20.88	18.0	4:38	20.52	17.8
			4:55	20.79	18.0	5: 0	20.08	17.9
			5:16	19.79	17.9	5:21	19.30	17.8
			5:38	19.47	17.7	5:43	18.93	17.8
			6: 0	18.86	17.7	6: 5	17.94	17.8
			6:21	18.50	17.8	6:26	17.54	17.8
			6:43	18.30	17.8	6:48	16.84	17.7
			7: 4	17.34	17.7	7: 9	16.71	17.7
			7:26	-0.22	18.0	7:31	16.14	17.7
			7:47	17.48	17.8	7:52	16.15	17.7
			8: 9	17.10	17.8	8:14	15.76	17.8
			8:30	16.88	17.7	8:36	15.99	17.7
			8:52	16.85	17.7	8:57	15.80	17.7
			9:14	16.49	17.7	9:19	15.77	17.7
			9:35	16.88	17.7	9:40	15.32	17.7
			9:57	16.34	17.8	10: 2	15.46	17.6
			10:18	16.12	17.8	10:25	15.30	17.7
10:55	12.98	17.2	10:40	15.86	17.8	10:46	15.18	17.6
11:16	12.40	16.9	11: 1	15.83	17.7	11: 7	15.50	17.7
11:38	12.55	17.0	11:23	15.82	17.8	11:28	15.16	17.7
12: 1	12.42	17.1	11:45	15.88	17.8	11:50	15.08	17.7
12:22	12.72	17.2	12: 6	15.71	17.7	12:11	15.04	17.7
12:44	13.88	17.3	12:28	16.51	17.8	12:33	15.88	17.8
13: 5	14.10	17.3	12:50	16.79	17.7	12:55	16.15	17.9
13:27	14.96	17.4	13:11	17.08	17.8	13:16	16.74	17.9
13:48	15.15	17.6	13:32	17.89	17.8	13:38	16.65	17.8
14:10	15.63	17.6	13:54	18.82	17.9	14: 0	17.83	17.9
14:32	17.97	17.4	14:15	19.07	17.8	14:21	17.75	18.0
14:53	17.64	17.6	14:37	19.47	17.9			
15:15	17.82	17.6	15: 0	20.02	17.9			
15:37	18.81	17.7	15:20	20.25	18.0			
15:58	18.52	17.8	15:42	20.88	18.0			
16:20	19.51	17.8	16: 3	21.12	17.9			
16:41	19.66	17.8	16:25	21.27	18.1			
17:25	20.52	17.9	16:46	21.81	18.2			
17:46	19.82	17.9	17: 8	21.58	18.4			
18: 6	20.61	17.9	17:30	21.79	18.2			
18:28	20.15	17.9	17:51	21.79	18.2			
18:51	20.73	17.9	18:13	22.14	18.1			
19:12	21.01	18.0	18:34	22.99	18.1			
19:34	21.26	17.9	18:56	23.27	18.3			
19:55	21.74	18.0	19:17	23.37	18.3			
20:17	22.05	17.9	19:39	23.71	18.5			
20:38	22.09	18.1	20: 1	23.68	18.4			
21: 0	22.22	17.9	20:22	23.24	18.5			
21:22	22.36	17.9	20:44	23.27	18.7			
21:43	23.10	18.0	21: 5	22.93	18.5			
22: 5	23.86	18.0	21:27	23.14	18.5			
22:27	23.73	17.9	21:48	23.29	18.5			
22:48	23.63	17.9	22:10	23.26	18.5			
23:10	23.77	18.3	22:32	23.25	18.5			
23:31	23.80	17.9	22:53	23.89	18.5			
23:53	23.63	18.0	23:15	24.11	18.6			

These data were collected under file SBT#24

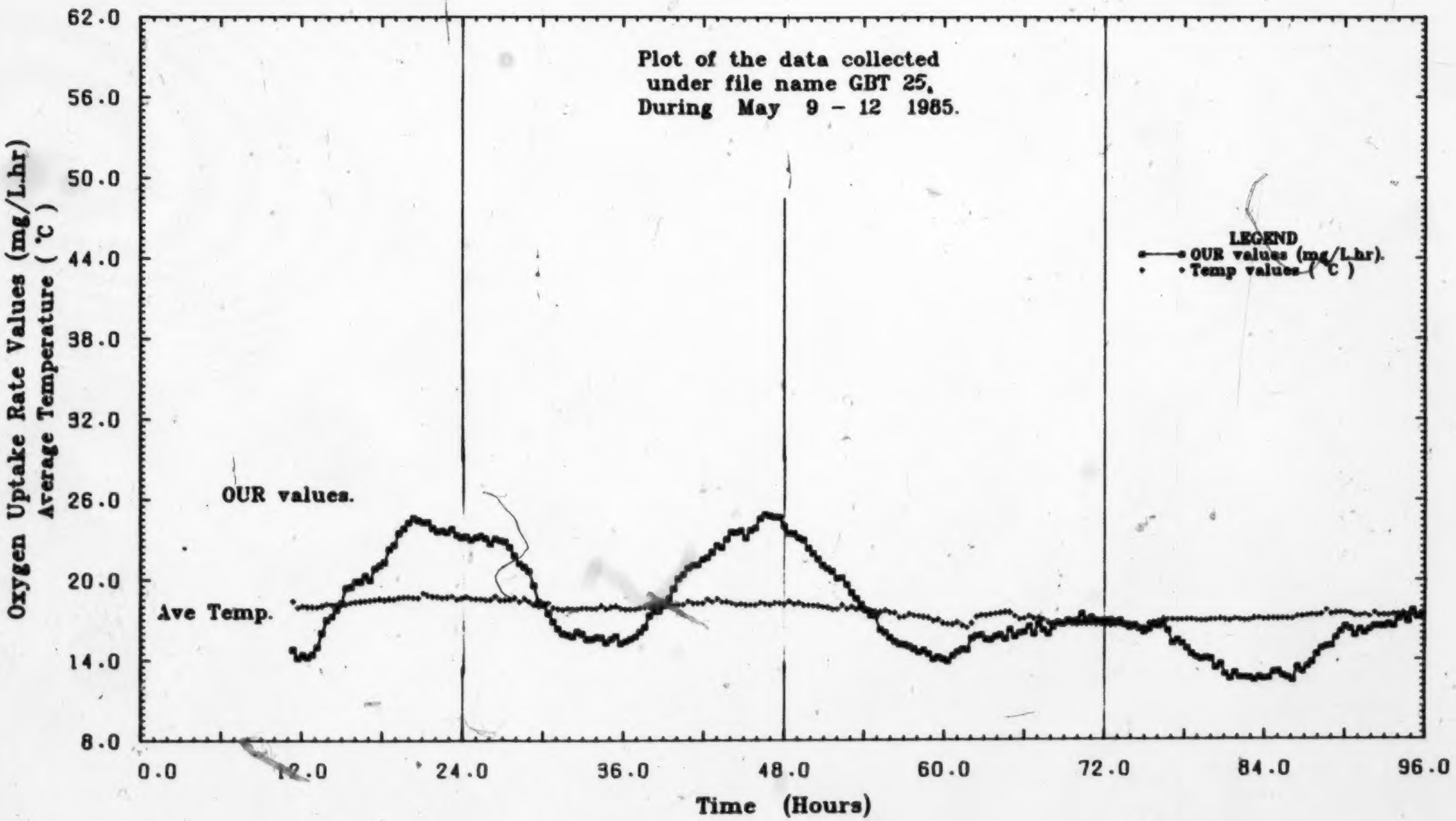


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 9-12 / 5 / 1985)

DAY 1 9 5 85			DAY 2 10 5 85			DAY 3 11 5 85			DAY 4 12 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:15	23.21	18.6	0:20	23.49	18.4	0: 3	16.89	16.5
			0:36	22.99	18.6	0:42	23.45	18.2	0:25	16.94	16.6
			0:58	23.17	18.6	1: 3	23.14	18.3	0:47	16.60	16.6
			1:19	23.28	18.6	1:25	22.89	18.1	1: 8	16.50	16.6
			1:41	23.10	18.5	1:47	22.35	18.1	1:30	16.61	16.6
			2: 2	22.89	18.5	2: 8	21.95	18.1	1:51	16.39	16.7
			2:25	23.06	18.6	2:30	21.55	18.1	2:13	16.56	16.5
			2:46	22.94	18.5	2:51	21.08	18.0	2:34	16.31	16.4
			3: 7	22.63	18.5	3:13	20.84	17.9	2:56	16.05	16.4
			3:29	22.43	18.5	3:34	20.63	17.8	3:18	16.26	16.7
			3:50	21.60	18.7	3:56	20.11	17.8	3:39	15.58	16.8
			4:12	21.21	18.4	4:17	20.16	18.1	4: 1	15.52	16.9
			4:34	20.95	18.5	4:39	19.85	17.8	4:22	15.51	17.0
			4:55	20.53	18.4	5: 1	19.04	18.0	4:44	15.17	17.0
			5:17	19.56	18.1	5:22	18.60	17.8	5: 5	15.24	17.0
			5:38	18.34	18.1	5:44	18.17	17.9	5:27	15.45	17.0
			6: 0	18.14	18.3	6: 5	17.72	17.8	5:48	15.20	17.0
			6:22	17.49	18.3	6:27	17.33	17.7	6:10	14.84	17.0
			6:43	16.66	17.9	6:50	17.30	17.8	6:31	14.41	17.0
			7: 5	16.34	17.8	7:10	16.28	17.8	6:53	14.18	17.0
			7:26	15.98	17.8	7:32	16.06	17.7	7:15	14.04	17.0
			7:48	15.68	17.9	7:53	15.68	17.8	7:36	14.15	16.9
			8:10	15.75	17.8	8:15	15.39	17.5	7:58	14.06	17.0
			8:31	15.11	17.8	8:36	15.19	17.2	8:19	13.39	17.0
			8:53	15.04	17.9	8:58	15.15	17.2	8:41	13.86	17.1
			9:14	15.64	17.9	9:20	15.01	17.5	9: 2	12.82	17.0
			9:36	15.57	17.9	9:41	14.83	17.3	9:25	12.56	16.9
			9:57	15.73	17.9	10: 3	14.57	17.3	9:45	12.59	17.1
			10:19	15.67	18.1	10:25	14.73	17.2	10: 7	12.66	17.0
			10:40	15.29	17.8	10:46	14.45	17.2	10:29	12.56	17.0
			11: 2	15.58	18.0	11: 8	14.05	16.9	10:50	12.55	17.0
11:19	14.79	18.4	11:25	15.77	18.0	11:29	14.21	17.0	11:12	12.46	17.1
11:41	14.17	17.9	11:45	15.23	17.9	11:51	14.07	16.7	11:33	12.70	17.1
12: 2	14.40	18.1	12: 7	15.38	17.8	12:12	13.91	16.7	11:55	12.89	17.1
12:25	14.23	18.0	12:28	15.57	17.8	12:34	14.32	16.7	12:16	12.63	17.1
12:45	14.45	18.0	12:50	15.75	17.8	12:55	14.60	16.8	12:38	13.07	17.1
13: 7	15.00	18.0	13:11	16.08	17.9	13:17	14.80	16.8	13: 0	13.12	17.1
13:28	15.03	18.0	13:33	16.45	18.0	13:39	14.75	16.4	13:21	12.79	17.1
13:50	15.95	18.2	13:54	17.29	18.0	14: 0	15.60	16.7	13:42	12.87	17.1
14:12	17.28	18.2	14:16	17.64	18.2	14:22	15.80	17.2	14: 4	12.46	17.1
14:33	17.75	18.2	14:38	17.57	18.0	14:43	15.67	17.3	14:26	13.45	17.3
14:55	18.28	18.2	15: 0	18.07	18.0	15: 5	15.53	17.3	14:47	13.10	17.3
15:16	19.38	18.2	15:21	18.80	18.1	15:26	15.51	17.4	15: 9	13.49	17.3
15:38	19.47	18.3	15:42	19.33	18.1	15:48	15.78	17.5	15:30	13.61	17.4
16: 0	19.65	18.4	16: 4	20.07	18.2	16: 9	15.88	17.5	15:52	14.40	17.3
16:21	19.85	18.4	16:25	20.40	18.2	16:31	15.58	17.6	16:13	14.84	17.4
16:42	20.28	18.4	16:47	20.67	18.4	16:52	16.29	17.6	16:35	15.00	17.7
17: 4	19.97	18.5	17: 9	21.09	18.3	17:14	15.78	17.3	16:57	15.04	17.4
17:25	20.83	18.5	17:30	21.12	18.3	17:35	16.00	17.0	17:18	15.65	17.5
17:47	21.09	18.5	17:52	21.53	18.3	17:57	16.06	17.1	17:40	16.10	17.5
18: 8	21.30	18.5	18:13	21.86	18.5	18:18	16.48	17.3	18: 1	16.50	17.5
18:30	22.38	18.6	18:35	22.06	18.4	18:40	15.91	17.1	18:23	16.31	17.5
18:51	22.56	18.6	18:57	22.57	18.5	19: 2	15.94	17.2	18:44	16.63	17.3
19:13	23.48	18.7	19:18	22.41	18.4	19:23	16.21	17.0	19: 6	16.26	17.3
19:35	23.62	18.7	19:40	23.03	18.4	19:45	15.93	16.8	19:27	16.02	17.4
19:56	24.28	18.7	20: 1	23.58	18.3	20: 6	16.43	16.7	19:50	16.29	17.3
20:18	24.61	18.7	20:23	23.55	18.2	20:28	15.70	16.7	20:11	16.53	17.6
20:39	24.44	18.7	20:44	23.66	18.2	20:50	15.66	16.7	20:32	16.53	17.3
21: 1	24.29	19.0	21: 6	23.12	18.1	21:11	15.94	16.8	20:54	16.51	17.4
21:22	24.31	18.9	21:27	23.70	18.2	21:33	16.88	16.7	21:15	16.55	17.3
21:44	23.85	18.8	21:50	23.86	18.1	21:54	16.90	16.8	21:37	16.63	17.4
22: 5	23.59	18.7	22:11	24.59	18.3	22:16	17.42	16.7	21:58	17.08	17.4
22:27	23.08	18.7	22:32	24.52	18.2	22:37	16.98	16.7	22:20	17.24	17.5
22:50	23.64	18.7	22:54	24.79	18.2	23: 0	17.15	16.7	22:42	16.88	17.4
23:10	23.79	18.6	23:15	24.22	18.3	23:20	16.82	16.7	23: 3	17.71	17.4
23:32	23.33	18.5	23:37	24.71	18.3	23:42	16.90	16.7	23:25	17.22	17.3
23:53	23.15	18.6	23:58	24.03	18.2	0: 3	16.89	16.6	23:46	17.48	17.3

These data were collected under file CBT#25A

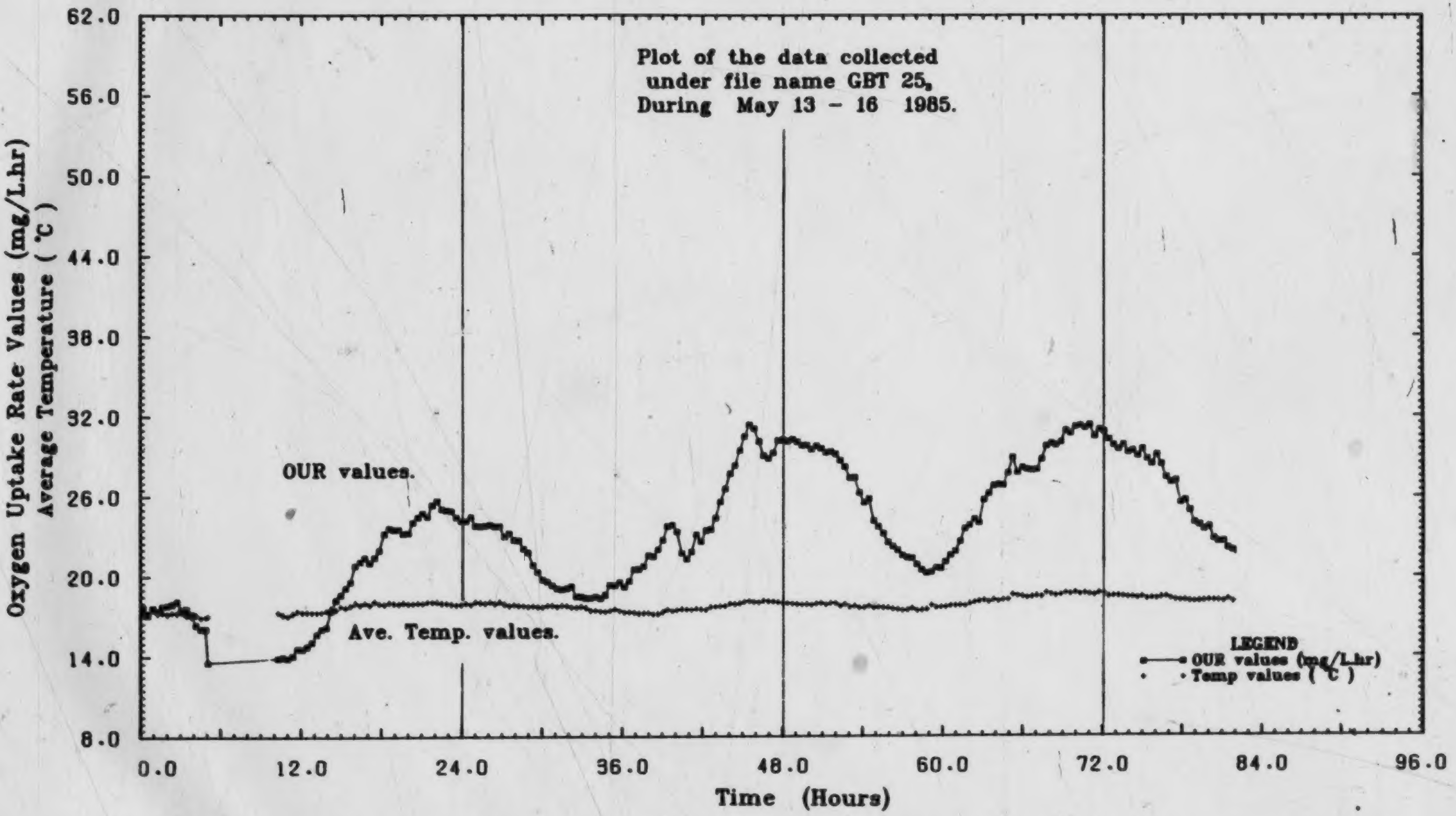


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 13-16 / 5 / 1985)

DAY 1 13 5 85			DAY 2 14 5 85			DAY 3 15 5 85			DAY 4 16 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:13	24.20	18.0	0:17	30.17	18.1	0: 0	30.59	18.6
0: 8	17.72	17.4	0: 8	17.72	17.4	0:39	30.32	18.0	0:21	30.32	18.5
0:29	17.14	17.3	0:29	17.14	17.3	1: 0	30.12	18.0	0:43	29.86	18.6
0:51	17.68	17.5	0:51	17.68	17.5	1:22	29.85	18.0	1: 5	29.56	18.6
1:13	17.47	17.3	1:13	17.47	17.3	1:43	29.87	18.0	1:26	29.91	18.5
1:34	17.52	17.3	1:34	17.52	17.3	2: 5	29.54	17.9	1:48	29.34	18.5
1:56	17.86	17.2	1:56	17.86	17.2	2:26	29.61	18.0	2: 9	29.46	18.5
2:17	17.89	17.3	2:17	17.89	17.3	2:48	29.61	18.1	2:31	29.08	18.4
2:39	18.19	17.3	2:39	18.19	17.3	3:10	29.31	17.9	2:52	29.56	18.5
3: 0	17.91	17.4	3: 0	17.91	17.4	3:31	29.37	18.1	3:14	28.89	18.4
3:22	17.53	17.1	3:22	17.53	17.1	3:53	29.19	18.1	3:35	28.46	18.4
3:44	17.22	17.0	3:44	17.22	17.0	4:14	28.71	17.8	3:57	29.15	18.4
4: 5	16.40	17.1	4: 5	16.40	17.1	4:36	28.24	18.0	4:18	28.46	18.5
4:27	16.11	17.0	4:27	16.11	17.0	4:57	27.42	17.8	4:40	27.47	18.5
4:48	16.10	17.0	4:48	16.10	17.0	5:19	27.43	17.8	5: 2	27.10	18.4
4:58	13.80	17.1	4:58	13.80	17.1	5:40	26.30	17.7	5:23	27.23	18.3
10:12	13.92	17.3	10:12	13.92	17.3	6: 2	25.57	17.7	5:45	25.56	18.2
10:33	14.00	17.2	10:33	14.00	17.2	6:23	25.84	17.8	6: 6	25.74	18.3
10:55	13.91	17.1	10:55	13.91	17.1	6:45	24.20	17.7	6:28	25.00	18.2
11:17	14.08	17.2	11:17	14.08	17.2	7: 6	23.77	17.7	6:50	24.10	18.2
11:38	14.52	17.4	11:38	14.52	17.4	7:28	23.26	17.7	7:11	23.92	18.2
12: 0	14.80	17.4	12: 0	14.80	17.4	7:50	22.60	17.7	7:32	23.50	18.2
12:21	14.80	17.4	12:21	14.80	17.4	8:11	22.28	17.6	7:54	23.79	18.3
12:43	15.11	17.3	12:43	15.11	17.3	8:33	22.01	17.6	8:15	22.89	18.2
13: 5	15.71	17.3	13: 5	15.71	17.3	8:54	21.52	17.5	8:37	22.57	18.2
13:26	16.10	17.4	13:26	16.10	17.4	9:15	21.45	17.5	9: 0	22.56	18.2
13:48	16.23	17.5	13:48	16.23	17.5	9:37	21.41	17.7	9:20	22.17	18.4
14: 9	17.44	17.7	14: 9	17.44	17.7	10: 0	20.93	17.5	9:42	22.00	18.1
14:31	18.27	17.5	14:31	18.27	17.5	10:21	20.52	17.5			
14:52	18.88	17.6	14:52	18.88	17.6	10:42	20.29	17.6			
15:14	19.16	17.7	15:14	19.16	17.7	11: 4	20.37	17.9			
15:36	19.62	17.6	15:36	19.62	17.6	11:25	20.70	17.7			
15:57	20.84	18.0	15:57	20.84	18.0	11:47	20.65	17.8			
16:19	21.14	17.9	16:19	21.14	17.9	12: 8	21.14	17.8			
16:40	21.44	18.1	16:40	21.44	18.1	12:30	21.63	17.9			
17: 2	21.05	17.9	17: 2	21.05	17.9	12:52	21.92	17.9			
17:25	21.45	18.2	17:25	21.45	18.2	13:13	22.66	17.9			
17:45	22.00	18.0	17:45	22.00	18.0	13:35	23.52	17.9			
18: 7	23.23	18.0	18: 7	23.23	18.0	13:56	23.89	18.0			
18:29	23.84	18.1	18:29	23.84	18.1	14:18	24.32	18.1			
18:50	23.55	18.0	18:50	23.55	18.0	14:39	24.05	18.2			
19:12	23.56	18.0	19:12	23.56	18.0	15: 1	25.75	18.3			
19:33	23.25	18.1	19:33	23.25	18.1	15:22	26.23	18.2			
19:55	23.29	18.0	19:55	23.29	18.0	15:44	26.61	18.3			
20:16	24.10	18.0	20:16	24.10	18.0	16: 6	26.90	18.2			
20:38	24.47	18.1	20:38	24.47	18.1	16:27	26.85	18.3			
21: 0	24.77	18.0	21: 0	24.77	18.0	16:50	27.75	18.3			
21:21	24.51	18.1	21:21	24.51	18.1	17:10	28.92	18.7			
21:42	25.38	18.1	21:42	25.38	18.1	17:32	27.61	18.6			
22: 4	25.58	18.1	22: 4	25.58	18.1	17:54	28.17	18.5			
22:25	25.06	18.0	22:25	25.06	18.0	18:15	28.04	18.5			
22:47	24.99	18.1	22:47	24.99	18.1	18:37	28.00	18.5			
23: 8	24.92	18.0	23: 8	24.92	18.0	18:58	28.02	18.6			
23:30	24.46	17.9	23:30	24.46	17.9	19:20	28.80	18.5			
23:52	24.20	17.9	23:52	24.20	17.9	19:41	29.79	18.8			

These data were collected under file SBT#258



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 16-19 / 5 / 1985)

DAY 1 16 5 85			DAY 2 17 5 85			DAY 3 18 5 85			DAY 4 19 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:18	38.68	19.6	0: 2	0.23	21.6	0: 7	27.29	19.7
			0:40	37.95	19.7	0:23	35.62	20.6	0:28	27.31	19.7
			1: 1	38.93	19.7	0:45	34.61	20.2	0:50	27.86	19.7
			1:23	38.29	19.7	1: 7	34.29	20.0	1:12	26.95	19.7
			1:44	38.32	19.8	1:28	33.46	20.2	1:33	27.23	19.6
			2: 6	36.25	19.8	1:50	32.99	20.1	1:55	27.17	19.7
			2:28	36.33	19.8	2:11	1.28	19.6	2:16	27.49	19.6
			2:50	36.14	19.6	2:33	33.90	20.2	2:38	26.90	19.6
			3:11	35.46	19.4	2:54	32.89	20.0	3: 0	26.57	19.6
			3:32	35.91	19.6	3:16	32.28	19.9	3:21	26.48	19.5
			3:54	34.96	19.7	3:37	31.66	19.9	3:42	26.46	19.4
			4:15	35.09	19.5	4: 0	31.02	19.7	4: 4	26.34	19.6
			4:36	34.70	19.5	4:21	30.61	19.7	4:26	26.49	19.5
			4:58	33.96	19.5	4:42	30.11	19.7	4:47	26.05	19.5
			5:19	33.50	19.4	5: 4	29.80	19.7	5: 9	25.23	19.4
			5:41	33.07	19.5	5:25	30.13	19.6	5:30	25.10	19.4
			6: 3	32.52	19.4	5:47	29.26	19.5	5:52	24.81	19.4
			6:25	31.99	19.7	6: 8	30.11	19.6	6:13	24.81	19.4
			6:46	30.57	19.4	6:30	28.71	19.7	6:35	24.65	19.4
			7: 7	29.48	19.3	6:52	27.85	19.6	6:56	24.35	19.3
			7:29	28.95	19.3	7:13	27.57	19.4	7:18	24.06	19.4
			7:50	27.92	19.3	7:35	26.94	19.5	7:40	23.30	19.4
			8:12	28.11	19.3	7:56	26.07	19.4	8: 1	23.38	19.4
			8:33	27.69	19.5	8:18	25.71	19.5	8:23	22.41	19.3
			8:55	27.06	19.5	8:39	25.38	19.4	8:44	22.75	19.3
			9:17	27.09	19.4	9: 1	24.34	19.4	9: 6	22.44	19.2
			9:38	26.59	19.3	9:23	24.20	19.4	9:27	22.48	19.2
			10: 0	26.31	19.4	9:44	24.48	19.4	9:50	21.75	19.2
			10:22	26.45	19.6	10: 6	23.78	19.4	10:10	22.31	19.3
			10:43	26.07	19.5	10:27	23.81	19.6	10:32	21.36	19.4
			11: 5	25.56	19.4	10:50	23.57	19.5	10:54	21.47	19.2
11: 0	26.52	19.6	11:26	25.59	19.4	11:11	23.21	19.5	11:15	21.25	19.2
11:22	25.10	19.1	11:48	25.21	19.6	11:32	23.05	19.3	11:37	21.04	19.2
11:44	24.37	18.9	12:10	25.37	19.7	11:54	22.89	19.3	11:58	21.15	19.1
12: 5	23.63	18.8	12:31	25.89	19.8	12:15	22.83	19.4	12:20	20.91	19.5
12:27	24.68	19.0	12:53	26.96	19.7	12:37	22.86	19.4	12:42	20.86	19.2
12:48	24.87	19.3	13:14	27.88	19.9	12:58	22.79	19.5	13: 3	20.74	19.2
13:10	26.04	19.1	13:36	28.49	20.0	13:20	22.45	19.5	13:25	20.89	19.3
13:31	25.87	19.1	13:58	29.07	19.9	13:42	22.68	19.5	13:46	21.47	19.4
13:53	26.86	19.1	14:19	29.89	19.8	14: 3	22.39	19.5	14: 8	21.44	19.4
14:15	27.97	19.1	14:41	30.77	20.0	14:25	22.89	19.5	14:29	21.10	19.4
14:36	28.64	19.3	15: 2	31.37	20.0	14:46	22.75	19.5	14:51	21.30	19.6
14:58	29.37	19.3	15:25	32.45	19.9	15: 8	24.01	19.5	15:13	21.94	19.4
15:19	30.34	19.4	15:45	32.43	20.1	15:29	24.33	19.5	15:34	22.38	19.5
15:41	31.44	19.4	16: 7	33.04	20.1	15:51	24.49	19.5	15:56	22.33	19.5
16: 2	31.96	19.4	16:28	33.70	20.3	16:12	25.06	19.6	16:17	22.59	19.5
16:25	32.16	19.6	16:50	34.00	20.2	16:34	25.16	19.6	16:39	22.31	19.4
16:45	32.87	19.6	17:12	34.23	20.2	16:56	25.36	19.7	17: 0	22.98	19.5
17: 7	33.35	19.7	17:33	34.59	20.2	17:17	26.30	19.6	17:22	23.02	19.7
17:28	33.26	19.5	17:55	35.13	20.4	17:39	26.65	19.6	17:44	23.01	19.6
17:50	34.24	19.7	18:16	35.49	20.6	18: 0	26.56	19.9	18: 5	23.51	19.5
18:12	33.60	19.6	18:38	35.93	20.3	18:22	26.95	19.9	18:27	24.32	19.6
18:33	34.72	19.6	19: 0	37.02	20.4	18:44	27.52	19.9	18:48	24.25	19.6
18:55	34.90	19.9	19:21	37.57	20.4	19: 5	27.86	19.8	19:10	24.05	19.6
19:16	36.22	19.6	19:43	37.75	20.3	19:27	28.25	20.1	19:31	24.84	19.7
19:38	37.70	19.9	20: 4	1.10	19.5	19:48	28.04	19.8	19:53	24.54	19.8
20: 0	37.96	19.9	20:26	39.92	20.7	20:10	28.16	19.8	20:15	24.66	19.7
20:21	38.53	20.0	20:47	39.46	20.5	20:31	28.17	19.7	20:36	24.62	19.6
20:42	40.34	20.0	21: 9	38.61	20.4	20:53	27.35	19.7	20:58	24.26	19.6
21: 4	41.31	20.0	21:30	37.93	20.3	21:15	27.70	19.8	21:19	24.35	19.6
21:26	40.98	20.0	21:52	37.48	20.3	21:36	27.24	19.8	21:41	24.32	19.7
21:47	39.89	19.6	22:14	1.35	19.5	21:58	26.91	19.8	22: 3	24.66	19.5
22: 9	38.61	19.8	22:35	37.24	20.5	22:19	27.15	19.7	22:25	24.70	19.7
22:30	39.06	20.0	22:57	35.23	20.3	22:41	27.07	19.8	22:46	24.72	19.5
22:52	39.36	19.8	23:18	34.75	20.3	23: 2	27.08	19.7	23: 7	24.59	19.4
23:14	38.26	19.7	23:40	35.41	20.6	23:25	27.34	19.8	23:29	24.93	19.3
23:36	10.70	20.3	0: 2	0.23	21.6	23:45	27.61	19.7	23:51	24.85	19.5
23:57	39.96	19.9	0:23	35.62	20.6	0: 7	27.29	19.7	0:12	24.32	19.5

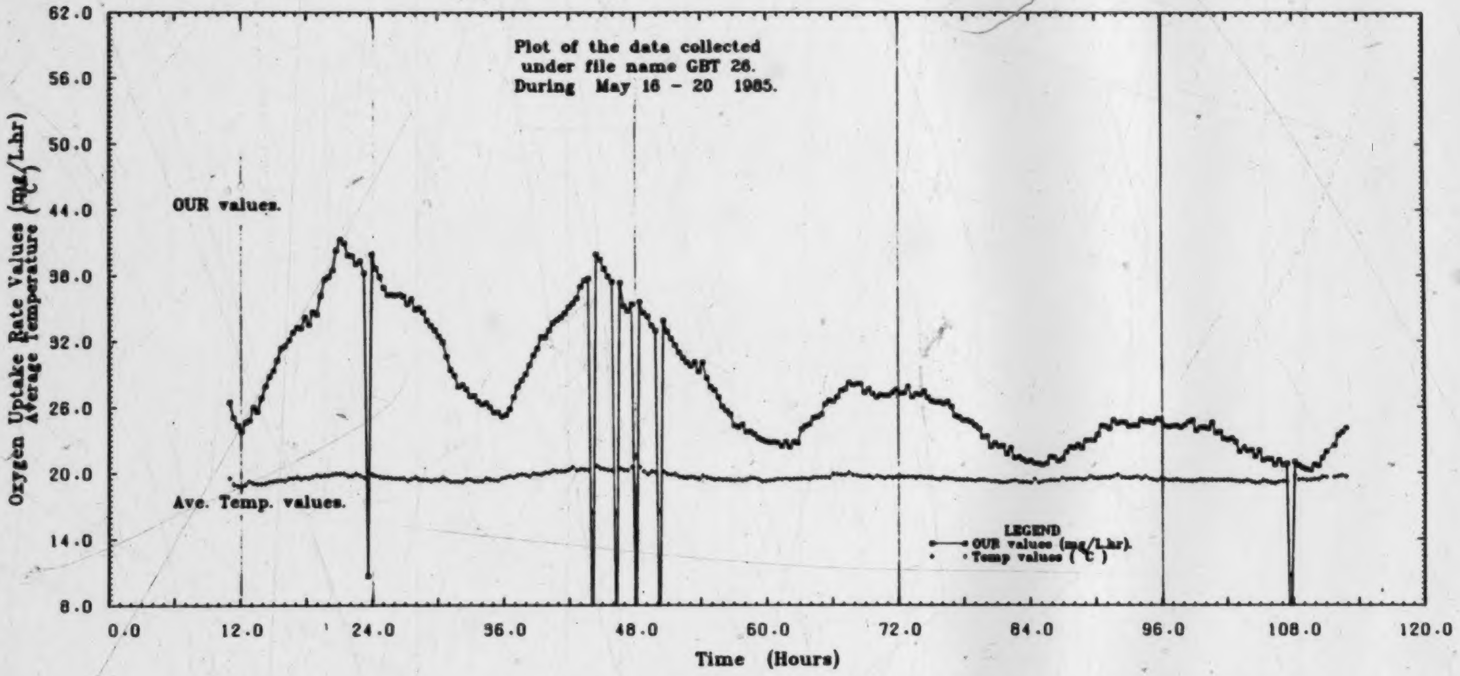
These data were collected under file GBT#26

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 20 / 5 / 1985)

DAY 5 20 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0:12	24.32	18.5
0:34	24.22	18.4
0:55	24.30	18.4
1:17	24.32	18.4
1:39	24.17	18.3
2: 0	24.37	18.3
2:22	24.66	18.3
2:43	24.80	18.3
3: 5	23.88	18.3
3:26	24.17	18.4
3:48	24.18	18.4
4:10	24.08	18.4
4:31	24.58	18.4
4:53	23.66	18.4
5:14	23.72	18.4
5:36	23.12	18.4
5:57	23.04	18.4
6:19	23.18	18.4
6:40	22.84	18.3
7: 2	21.99	18.3
7:25	22.37	18.2
7:45	22.03	18.4
8: 7	22.08	18.2
8:28	21.51	18.1
8:50	22.05	18.1
9:12	21.18	18.4
9:33	21.31	18.2
9:55	21.26	18.1
10:16	20.74	18.1
10:38	21.17	18.2
11: 0	20.75	18.3
11:21	20.85	18.2
11:43	2.58	10.8
12: 4	21.03	18.6
12:26	20.71	18.4
12:47	20.49	18.5
13: 9	20.34	18.4
13:31	20.28	18.4
13:52	20.77	18.5
14:14	20.65	18.5
14:35	21.38	18.7
14:57	21.93	18.6
15:40	22.51	18.7
16: 2	23.48	18.7
16:23	23.72	18.8
16:45	24.12	18.7

These data were collected under file CB1926

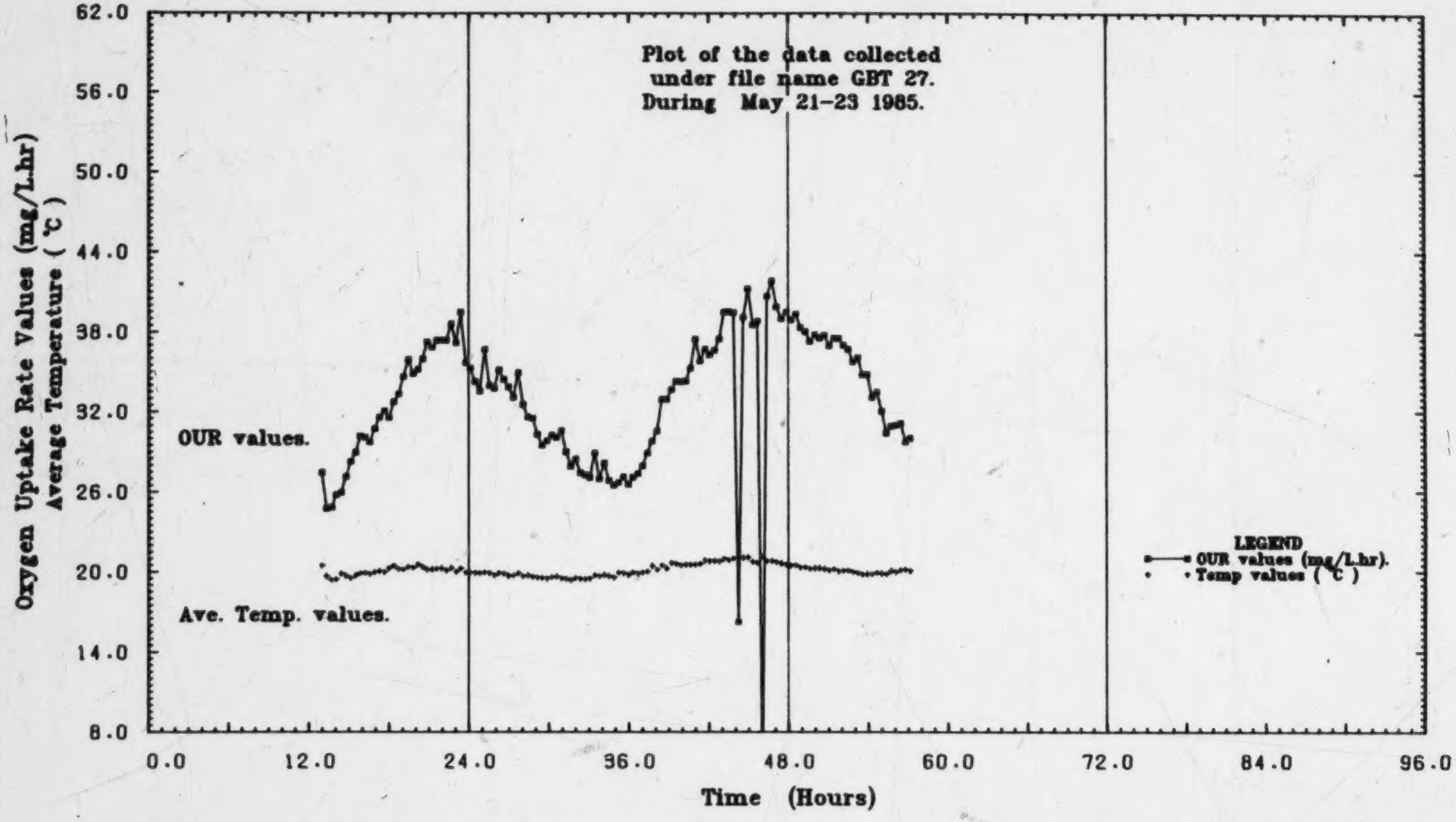


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 21-23 / 5 / 1985)

DAY 1			DAY 2			DAY 3		
21 5 85			22 5 85			23 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 5	35.26	20.0	0:10	36.91	20.5
			0:27	34.26	20.0	0:32	39.34	20.5
			0:48	33.57	19.9	0:53	38.34	20.4
			1:10	35.66	20.0	1:15	38.04	20.4
			1:31	33.99	19.9	1:36	37.31	20.3
			1:53	33.76	19.6	1:58	37.80	20.3
			2:14	35.15	19.8	2:19	37.57	20.3
			2:36	34.44	19:9	2:41	37.79	20.2
			2:57	33.87	19.7	3: 3	38.87	20.1
			3:19	33.09	19.8	3:25	37.55	20.2
			3:41	34.94	19.9	3:46	37.53	20.1
			4: 2	32.55	19.7	4: 7	37.02	20.1
			4:25	31.62	19.6	4:29	36.71	20.1
			4:45	31.54	19.7	4:50	35.79	20.0
			5: 7	30.32	19.6	5:12	36.07	20.0
			5:28	29.51	19.8	5:33	34.82	19.6
			5:50	28.64	19.9	5:55	34.81	19.8
			6:12	30.24	19.8	6:16	33.10	19.9
			6:33	30.09	19.7	6:38	33.48	19.9
			6:55	30.59	19.5	7: 0	32.06	19.9
			7:16	29.01	19.5	7:21	30.42	19.9
			7:38	27.95	19.4	7:43	30.85	20.1
			8: 0	28.47	19.6	8: 4	31.02	20.0
			8:21	27.45	19.5	8:26	31.17	20.2
			8:43	27.29	19.5	8:48	29.79	20.2
			9: 4	27.10	19.5	9: 9	30.04	20.1
			9:26	26.92	19.6			
			9:47	27.00	19.7			
			10: 9	26.15	19.6			
			10:30	26.87	19.7			
			10:52	26.51	19.8			
			11:13	26.72	20.0			
			11:35	27.11	19.9			
			11:57	26.57	19.8			
			12:18	27.10	20.0			
12:57	27.48	20.5	12:40	27.37	19.9			
13:18	24.60	19.7	13: 1	27.86	20.0			
13:40	24.86	19.4	13:23	28.94	20.0			
14: 1	25.64	19.5	13:44	29.80	20.5			
14:23	26.01	19.9	14: 6	30.57	20.2			
14:45	27.16	19.7	14:28	32.82	20.5			
15: 6	26.31	19.6	14:50	32.82	20.3			
15:28	28.99	19.8	15:11	33.66	20.7			
15:50	30.22	19.9	15:32	34.26	20.6			
16:11	30.11	20.0	15:54	34.26	20.5			
16:32	29.77	19.9	16:16	34.31	20.6			
16:54	30.75	20.0	16:37	35.27	20.6			
17:15	31.62	20.1	17: 0	37.44	20.6			
17:37	32.09	20.0	17:20	35.61	20.6			
17:58	31.61	20.3	17:42	36.59	20.9			
18:20	32.77	20.5	18: 3	36.26	20.8			
18:42	33.36	20.2	18:25	36.59	20.9			
19: 3	34.65	20.2	18:47	37.45	20.6			
19:25	35.93	20.4	19: 8	39.48	21.0			
19:47	34.90	20.3	19:30	39.50	20.9			
20: 8	35.20	20.5	19:51	39.44	21.0			
20:30	35.99	20.4	20:13	16.27	21.5			
20:51	37.25	20.2	20:35	39.11	21.1			
21:13	36.67	20.2	20:56	41.22	21.1			
21:34	37.38	20.3	21:18	36.54	20.6			
21:56	37.40	20.3	21:39	36.80	20.7			
22:17	37.38	20.1	22: 1	4.78	21.2			
22:39	36.61	20.3	22:22	40.66	20.8			
23: 1	37.19	20.0	22:44	41.82	20.6			
23:22	39.47	20.3	23: 5	38.86	20.6			
23:44	35.70	20.0	23:27	39.00	20.8			

These data were collected under file SBT#27



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 23-26 / 5 / 1985)

DAY 1			DAY 2			DAY 3			DAY 4		
23 5 85			24 5 85			25 5 85			26 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 1	38.58	20.6	0: 6	32.59	19.2	0:10	30.02	18.7
			0:23	38.38	20.4	0:27	32.49	19.2	0:32	30.09	18.8
			0:44	39.03	20.5	0:50	32.88	19.2	0:54	30.08	18.8
			1: 6	37.78	20.4	1:10	32.14	19.1	1:15	29.88	18.8
			1:27	0.44	21.9	1:32	33.35	19.4	1:37	30.09	18.6
			1:50	39.24	20.6	1:53	32.45	19.2	1:58	29.37	18.5
			2:10	39.27	20.5	2:15	32.82	19.1	2:20	29.04	18.5
			2:32	40.08	20.5	2:36	32.64	19.1	2:41	28.41	18.4
			2:53	38.39	20.3	2:58	32.53	19.0	3: 3	28.97	18.5
			3:15	37.91	20.2	3:20	32.84	19.1	3:25	28.03	18.4
			3:36	39.20	20.3	3:41	32.20	19.3	3:46	28.87	18.5
			3:58	39.63	20.4	4: 3	32.27	19.0	4: 7	29.38	18.6
			4:20	39.85	20.5	4:25	32.02	19.0	4:29	28.11	18.6
			4:41	39.88	20.5	4:46	31.79	19.1	4:51	28.10	18.5
			5: 3	37.58	20.6	5: 7	31.67	19.0	5:12	28.05	18.5
			5:25	36.06	20.1	5:29	31.24	19.0	5:34	27.48	18.5
			5:46	-0.37	20.6	5:51	31.08	19.1	5:55	27.02	18.3
			6: 7	35.52	20.1	6:12	31.03	19.2	6:17	26.83	18.2
			6:29	33.07	20.0	6:34	30.43	19.1	6:38	25.84	18.3
			6:50	31.78	20.0	6:55	30.11	19.1	7: 0	25.80	18.3
			7:12	30.62	19.9	7:17	29.71	19.2	7:21	25.28	18.3
			7:33	29.67	19.8	7:39	28.92	19.2	7:43	26.05	18.3
			7:55	30.57	19.7	8: 0	28.52	19.2	8: 5	24.61	18.3
			8:17	29.75	19.5	8:22	27.37	19.1	8:26	24.23	18.3
			8:38	29.63	19.4	8:43	27.54	19.1	8:48	23.98	18.3
			9: 0	29.48	19.2	9: 5	26.72	19.1	9: 9	23.71	18.4
			9:21	29:02	19.3	9:26	27.03	19.1	9:31	23.70	18.5
			9:43	28.01	19.3	9:48	25.95	19.1	9:52	23.84	18.4
			10: 4	27.88	19.3	10: 9	25.42	19.0	10:14	23.80	18.6
10: 1	26.53	20.4	10:26	27.35	19.0	10:31	24.88	19.0	10:36	23.54	18.5
10:23	27.47	20.1	10:48	26.49	18.9	10:53	24.15	19.0	10:57	23.28	18.5
10:44	26.95	19.9	11: 9	26.33	18.9	11:14	23.49	19.1	11:19	23.14	18.5
11: 6	26.45	20.0	11:31	26.16	18.8	11:36	23.75	18.7	11:40	22.98	18.4
11:27	27.10	20.0	11:52	25.83	18.8	11:57	23.19	18.5	12: 2	22.83	18.4
11:50	27.30	20.1	12:14	25.40	18.7	12:19	23.35	18.5	12:23	22.73	18.6
12:10	27.52	20.3	12:35	25.56	18.5	12:40	23.47	18.4	12:45	22.27	18.4
12:32	27.58	20.3	12:57	26.11	18.6	13: 2	23.77	18.5	13: 6	22.58	18.4
12:53	28.02	20.3	13:19	25.86	18.9	13:25	23.83	18.4	13:28	22.59	18.4
13:15	28.95	20.2	13:40	26.00	18.7	13:45	23.94	18.5	13:50	22.89	18.6
13:36	29.83	20.3	14: 2	26.12	18.8	14: 7	24.07	18.6	14:11	22.79	18.5
13:58	29.21	20.2	14:23	26.26	18.7	14:28	24.01	18.4	14:33	22.98	18.4
14:19	29.80	20.3	14:45	26.84	18.8	14:50	23.94	18.4	14:54	23.40	18.4
14:41	31.17	20.4	15: 6	28.17	18.8	15:11	24.05	18.4	15:16	23.89	18.5
15: 2	31.67	20.5	15:28	29.02	19.1	15:33	24.82	18.4	15:37	23.54	18.4
15:25	32.29	20.5	15:50	29.97	18.9	15:54	24.68	18.5	16: 0	23.95	18.5
15:46	33.72	20.4	16:11	31.22	18.9	16:16	24.71	18.4	16:20	24.35	18.6
16: 7	35.26	20.5	16:33	33.19	19.4	16:37	24.50	18.3	16:42	24.88	18.6
16:29	35.72	20.5	16:54	33.86	19.1	17: 0	25.37	18.6	17: 4	25.23	18.8
16:50	37.83	20.6	17:16	36.00	19.1	17:21	25.82	18.3	17:25	25.78	18.7
17:12	38.82	20.8	17:37	37.55	19.4	17:42	25.52	18.5	17:47	26.24	18.8
17:33	38.73	20.6	18: 0	38.48	19.3	18: 4	26.85	18.5	18: 8	26.84	18.7
17:55	38.44	20.7	18:21	38.89	19.4	18:25	26.54	18.6	18:30	27.23	18.8
18:16	39.19	20.6	18:42	38.10	19.4	18:47	27.28	18.5	18:51	27.28	18.7
18:38	39.02	20.6	19: 4	37.57	19.5	19: 9	27.97	18.5	19:13	28.08	18.8
19: 0	39.61	20.6	19:25	35.36	19.4	19:30	28.42	18.4	19:34	28.09	19.0
19:21	37.84	20.9	19:47	34.81	19.2	19:52	28.21	18.6	19:56	27.92	18.8
19:43	37.28	20.6	20: 8	34.27	19.1	20:13	28.49	18.4	20:18	28.01	18.8
20: 4	38.51	20.7	20:30	32.84	19.0	20:35	28.78	18.4	20:39	28.00	18.8
20:26	38.51	20.7	20:51	33.14	19.0	20:57	29.41	18.4	21: 1	28.31	18.8
20:47	38.70	20.7	21:13	32.89	19.1	21:18	30.01	18.5	21:22	28.19	18.9
21: 9	38.12	20.7	21:35	33.02	19.1	21:40	30.00	18.5	21:44	27.65	18.8
21:30	38.64	20.7	21:56	32.67	19.1	22: 1	29.[illegible]	18.5	22: 5	28.05	18.8
21:52	40.48	20.8	22:18	32.93	19.0	22:23	29.7[illegible]	18.6	22:27	27.78	18.8
22:13	39.57	20.8	22:39	33.04	19.0	22:44	29.28	18.5	22:48	28.20	18.7
22:35	39.21	20.7	23: 1	34.11	19.4	23: 6	29.61	18.5	23:10	28.33	18.8
22:56	41.08	20.8	23:22	33.17	19.3	23:27	29.48	18.6	23:32	28.85	18.8
23:16	39.51	20.6	23:44	32.93	19.2	23:50	30.28	18.6	23:53	28.17	18.7
23:38	38.44	20.6									

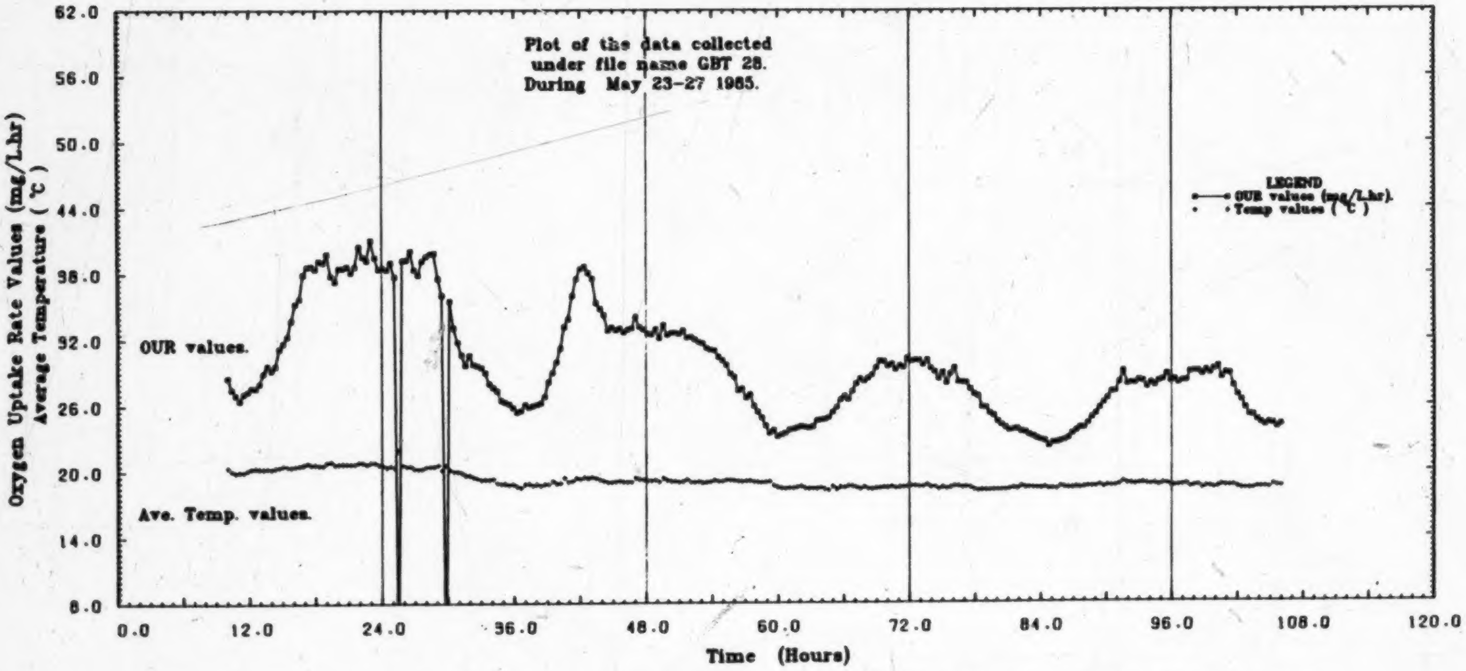
These data were collected under file GBT#28

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 27 / 5 / 1988)

DAY 5 27 5 88		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0:15	28.33	18.6
0:36	28.03	18.7
0:58	28.23	18.7
1:19	28.24	18.8
1:41	29.03	18.5
2: 3	29.08	18.8
2:25	29.06	18.7
2:46	28.60	18.4
3: 7	29.19	18.8
3:28	28.92	18.6
3:50	29.28	18.5
4:12	29.54	18.5
4:33	28.52	18.7
4:55	28.92	18.7
5:17	28.69	18.7
5:38	27.75	18.7
6: 0	26.95	18.5
6:21	26.47	18.4
6:43	25.75	18.4
7: 5	25.14	18.4
7:26	25.07	18.4
7:48	24.88	18.5
8: 9	24.40	18.5
8:31	24.18	18.5
8:52	24.41	18.5
9:14	24.32	18.6
9:36	24.00	18.6
9:57	24.26	18.6

These data were collected under file OBT#28

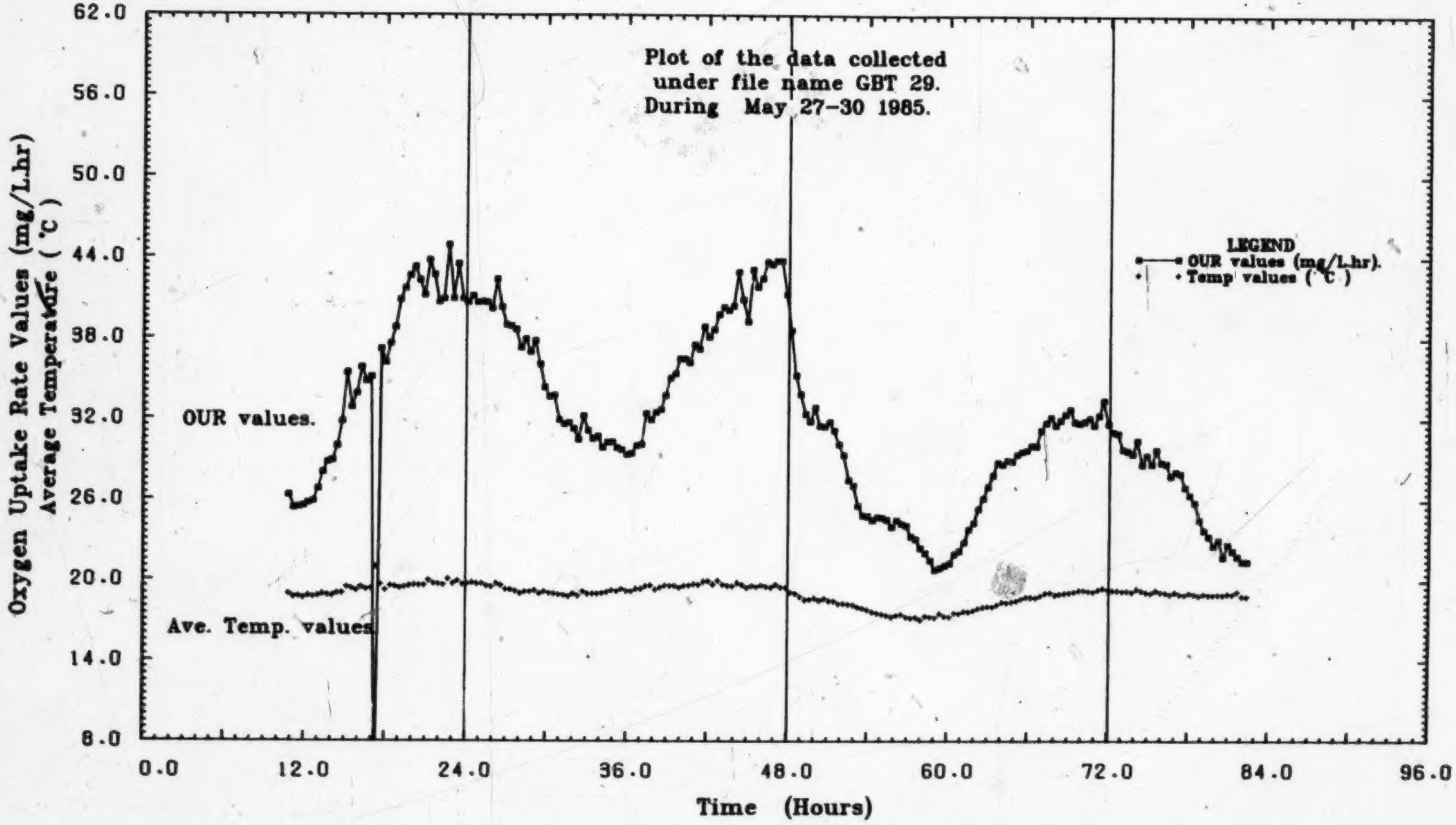


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 27-30 / 5 / 1985)

DAY 1 27 5 85			DAY 2 28 5 85			DAY 3 29 5 85			DAY 4 30 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 5	40.64	19.7	0:10	36.59	19.1	0:14	31.06	19.3
			0:27	41.10	19.6	0:32	35.24	19.0	0:36	30.88	19.3
			0:50	40.65	19.7	0:53	33.64	18.8	0:58	29.80	19.2
			1:10	40.70	19.7	1:15	32.38	18.6	1:19	29.89	19.2
			1:32	40.54	19.5	1:36	31.63	18.8	1:41	29.46	19.2
			1:53	40.19	19.5	1:58	32.66	18.7	2: 2	30.45	19.4
			2:15	42.37	19.7	2:19	31.50	18.5	2:25	28.70	19.3
			2:36	40.29	19.6	2:41	31.46	18.7	2:45	29.37	19.1
			2:58	38.88	19.3	3: 3	31.77	18.6	3: 7	28.71	19.1
			3:19	38.69	19.3	3:25	31.14	18.5	3:28	29.76	19.3
			3:41	38.63	19.2	3:46	30.12	18.3	3:50	28.62	19.1
			4: 3	37.29	19.0	4: 7	28.31	18.3	4:12	28.75	19.1
			4:25	37.90	19.1	4:29	27.47	18.2	4:33	27.84	19.0
			4:46	36.85	19.1	4:51	27.06	18.2	4:55	28.15	19.1
			5: 7	37.77	19.2	5:12	25.55	18.0	5:16	26.02	19.0
			5:28	38.02	19.0	5:34	24.62	17.9	5:38	27.00	19.0
			5:50	34.33	19.1	5:55	24.78	17.8	6: 0	26.43	19.1
			6:12	33.84	19.0	6:17	24.49	17.8	6:21	25.86	19.0
			6:33	33.73	19.0	6:38	24.72	17.6	6:42	24.57	18.9
			6:55	31.92	18.8	7: 0	24.67	17.5	7: 4	23.78	19.0
			7:17	31.61	18.8	7:21	24.52	17.4	7:26	23.33	19.0
			7:38	31.89	18.8	7:43	23.89	17.3	7:47	22.83	19.0
			8: 0	31.25	19.0	8: 5	24.46	17.4	8: 9	23.04	19.0
			8:21	30.45	18.8	8:26	24.23	17.5	8:30	21.79	19.0
			8:43	32.20	19.1	8:48	24.06	17.3	8:52	22.71	19.1
			9: 4	31.11	19.0	9: 9	23.26	17.2	9:13	22.25	19.0
			9:26	30.50	19.0	9:31	23.07	17.3	9:35	21.64	19.2
			9:47	30.88	19.0	9:52	22.42	17.1	9:57	21.46	18.9
			10: 9	29.57	19.0	10:14	22.03	17.4	10:18	21.44	18.9
10:48	26.31	19.0	10:31	30.24	19.1	10:36	21.50	17.3			
11:10	25.36	18.7	10:52	30.27	19.2	10:57	20.78	17.2			
11:31	25.41	18.6	11:14	29.85	19.2	11:19	20.82	17.5			
11:53	25.50	18.7	11:35	29.70	19.3	11:40	21.10	17.3			
12:15	25.73	18.6	11:57	29.33	19.2	12: 2	21.27	17.3			
12:36	25.86	18.7	12:18	29.42	19.2	12:25	21.88	17.6			
12:58	26.78	18.8	12:40	30.00	19.3	12:45	22.19	17.6			
13:19	26.00	18.9	13: 2	30.09	19.3	13: 7	22.63	17.7			
13:41	26.78	18.9	13:23	32.39	19.6	13:28	23.83	17.7			
14: 2	28.89	18.8	13:45	31.93	19.5	13:50	24.31	17.8			
14:25	29.85	19.0	14: 6	32.46	19.3	14:11	25.34	17.9			
14:46	31.79	19.0	14:28	32.71	19.5	14:33	26.12	18.0			
15: 7	35.40	19.5	14:50	33.74	19.5	14:54	27.00	18.1			
15:28	32.84	19.4	15:11	35.03	19.5	15:16	27.65	18.0			
15:50	33.87	19.2	15:33	35.36	19.6	15:37	28.60	18.2			
16:11	35.79	19.5	15:54	38.46	19.4	16: 0	28.65	18.4			
16:33	34.77	19.3	16:16	38.44	19.6	16:20	28.88	18.4			
16:55	35.08	19.4	16:37	38.19	19.6	16:42	28.89	18.4			
17:16	0.58	21.0	17: 0	37.52	19.7	17: 4	29.39	18.5			
17:38	37.18	19.7	17:20	37.20	19.7	17:25	29.60	18.7			
18: 0	36.18	19.2	17:42	36.66	19.9	17:47	29.70	18.8			
18:21	37.59	19.8	18: 3	38.11	19.9	18: 8	30.05	18.6			
18:42	38.79	19.5	18:25	38.66	19.7	18:30	30.02	18.7			
19: 4	40.64	19.4	18:47	39.76	20.0	18:51	31.16	18.9			
19:25	41.70	19.5	19: 8	40.32	19.7	19:13	31.75	19.1			
19:47	42.64	19.6	19:30	40.09	19.9	19:34	32.16	19.1			
20: 9	43.27	19.8	19:51	40.43	19.6	19:56	31.56	18.9			
20:30	42.29	19.8	20:13	42.94	19.6	20:17	31.86	19.0			
20:52	41.18	19.6	20:34	40.66	19.7	20:39	32.40	19.1			
21:13	43.77	20.0	20:56	39.29	19.5	21: 1	32.75	19.1			
21:35	42.89	19.7	21:18	43.11	19.6	21:22	31.63	19.2			
21:56	40.68	19.7	21:39	41.84	19.5	21:44	31.75	19.3			
22:18	40.91	19.8	22: 1	42.47	19.6	22: 5	31.66	19.3			
22:39	44.91	20.1	22:22	43.70	19.5	22:27	32.11	19.2			
23: 1	40.93	19.7	22:44	43.52	19.5	22:48	31.59	19.2			
23:22	43.51	19.9	23: 5	43.78	19.7	23:10	32.31	19.3			
23:44	40.84	19.7	23:27	43.78	19.5	23:31	33.42	19.4			

These data were collected under file OBT#29



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of May 30 to June 2 1985)

DAY 1			DAY 2			DAY 3			DAY 4		
30 5 85			31 5 85			1 4 85			2 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 5	26.46	19.6	0:10	26.40	19.2	0:15	22.10	19.1
			0:27	26.77	19.6	0:31	25.52	19.1	0:36	22.06	19.2
			0:48	26.02	19.6	0:53	25.03	19.0	0:58	22.02	19.0
			1:10	26.81	19.5	1:14	25.48	19.0	1:20	2P.88	19.0
			1:53	27.54	19.4	1:36	24.88	19.1	1:41	21.55	19.0
			2:15	27.07	19.5	1:57	25.58	19.3	2: 3	21.74	19.1
			2:36	26.98	19.2	2:19	25.69	19.2	2:25	21.11	19.1
			2:58	26.14	19.0	2:40	25.07	19.2	2:46	20.61	18.9
			3:19	25.85	18.9	3: 2	24.61	18.9	3: 7	20.63	18.9
			3:41	25.49	19.3	3:23	24.23	19.0	3:29	20.80	18.8
			4: 2	26.01	19.2	3:45	24.25	18.9	3:50	20.29	19.0
			4:25	25.56	19.3	4: 7	23.82	18.9	4:12	19.26	18.9
			4:45	26.36	19.2	4:28	24.88	19.2	4:33	18.51	18.8
			5: 7	25.85	19.0	4:50	23.78	19.0	4:55	19.12	18.8
			5:28	26.06	19.0	5:11	23.09	19.0	5:17	18.65	18.8
			5:50	23.33	18.7	5:33	22.57	18.8	5:38	18.60	18.8
			6:12	21.65	18.6	5:55	21.78	18.9	6: 0	18.23	18.8
			6:33	21.26	18.4	6:16	21.23	18.9	6:21	18.33	18.8
			6:55	20.42	18.4	6:38	20.88	18.9	6:43	18.19	18.8
			7:16	21.11	18.5	7: 0	20.18	18.9	7: 4	17.75	18.6
			7:38	21.60	18.5	7:21	19.87	18.7	7:26	17.28	18.7
			8: 0	21.54	18.3	7:43	20.17	18.8	7:47	18.17	18.7
			8:21	21.99	18.3	8: 4	19.53	18.7	8: 9	17.80	18.7
			8:43	21.69	18.2	8:26	19.41	18.6	8:30	17.63	18.8
			9: 4	21.82	18.3	8:47	19.40	18.7	8:52	16.87	18.7
			9:26	20.53	18.2	9: 9	18.87	18.8	9:14	16.92	18.6
			9:47	19.81	18.2	9:30	18.74	18.9	9:35	16.53	18.7
			10: 9	18.58	18.1	9:52	18.25	18.7	9:57	16.38	18.7
			10:30	17.14	18.0	10:14	18.25	18.8	10:18	16.17	18.6
			10:52	16.67	17.9	10:35	18.39	18.7	10:40	16.97	18.6
			11:13	15.72	17.9	10:57	18.17	18.7	11: 1	15.98	18.6
11:52	25.25	19.0	11:35	15.85	17.9	11:18	18.08	18.7	11:23	16.35	18.7
12:14	22.57	18.9	11:57	16.21	18.1	11:40	18.42	18.9	11:44	16.53	18.8
12:35	22.02	19.0	12:18	16.50	18.1	12: 1	18.27	18.7	12: 6	16.50	18.4
12:57	22.04	19.0	12:40	16.94	18.3	12:23	18.60	18.8	12:28	16.17	18.6
13:18	22.71	19.1	13: 1	17.32	18.2	12:45	18.55	18.8	12:50	15.67	18.5
13:40	23.23	19.1	13:23	18.03	18.2	13: 6	18.70	18.8	13:11	15.63	18.4
14: 1	23.06	19.3	13:44	18.88	18.2	13:28	18.80	18.8	13:32	15.78	18.5
14:23	23.43	19.2	14: 6	19.34	18.4	13:50	19.24	18.9	13:54	15.71	18.5
14:45	24.43	19.1	14:28	20.44	18.6	14:11	19.45	18.9	14:15	15.79	18.5
15: 6	25.32	19.2	14:50	21.15	18.6	14:32	19.98	18.8	14:37	15.78	18.5
15:28	25.17	19.3	15:11	21.97	18.7	14:54	20.09	18.9	14:58	15.93	18.5
15:50	25.74	19.2	15:32	22.55	18.8	15:15	20.53	18.8	15:20	16.00	18.5
16:11	26.49	19.3	15:54	23.06	18.8	15:37	20.29	19.1	15:42	16.48	18.5
16:32	26.63	19.4	16:15	23.72	18.8	16: 0	20.81	18.9	16: 3	16.61	18.5
16:54	27.04	19.3	16:37	23.63	18.8	16:20	21.16	19.1	16:25	17.02	18.6
17:15	28.29	19.5	16:58	23.55	18.8	16:42	21.13	19.2	16:46	17.99	18.6
17:37	28.29	19.5	17:20	23.29	18.8	17: 4	21.88	19.2	17: 8	17.79	18.7
18: 0	28.55	19.4	17:42	23.43	18.8	17:25	21.84	19.1	17:29	17.89	18.6
18:20	29.23	19.4	18: 3	24.67	19.1	17:47	21.81	19.0	17:51	18.52	18.6
18:42	31.04	19.7	18:25	24.62	19.1	18: 8	22.03	19.1	18:13	18.62	18.6
19: 3	30.21	19.6	18:46	25.13	19.0	18:30	21.88	18.9	18:34	18.60	18.6
19:25	30.93	19.6	19: 8	25.35	19.0	18:51	21.87	18.8	18:56	18.64	18.7
19:47	31.25	19.5	19:29	26.01	19.0	19:13	21.63	18.9	19:17	19.03	18.7
20: 8	32.13	19.7	19:51	26.65	19.3	19:35	21.57	18.9	19:39	19.06	18.6
20:30	31.88	19.6	20:12	26.94	19.6	19:56	21.44	18.9	20: 0	18.88	18.7
20:51	31.53	19.8	20:34	26.79	19.5	20:18	21.98	18.9	20:22	19.09	18.9
21:13	30.85	19.6	20:56	27.00	19.4	20:39	21.63	18.9	20:43	18.34	18.8
21:34	30.97	19.6	21:17	26.61	19.2	21: 1	21.71	19.0	21: 5	17.81	18.8
21:56	30.34	19.8	21:39	26.63	19.2	21:22	22.09	19.0	21:26	18.57	19.0
22:17	29.15	19.8	22: 0	26.59	19.1	21:44	22.08	18.9	21:48	17.93	18.7
22:38	28.38	19.6	22:22	26.64	19.1	22: 5	21.83	18.9	22:10	18.05	18.7
23: 0	28.63	19.7	22:43	26.56	19.1	22:27	22.09	19.0	22:31	17.92	18.9
23:22	28.26	19.8	23: 5	27.04	19.2	22:48	21.61	19.0	22:53	18.58	19.0
23:44	26.37	19.7	23:26	26.76	19.4	23:10	21.81	19.0	23:15	18.38	18.6

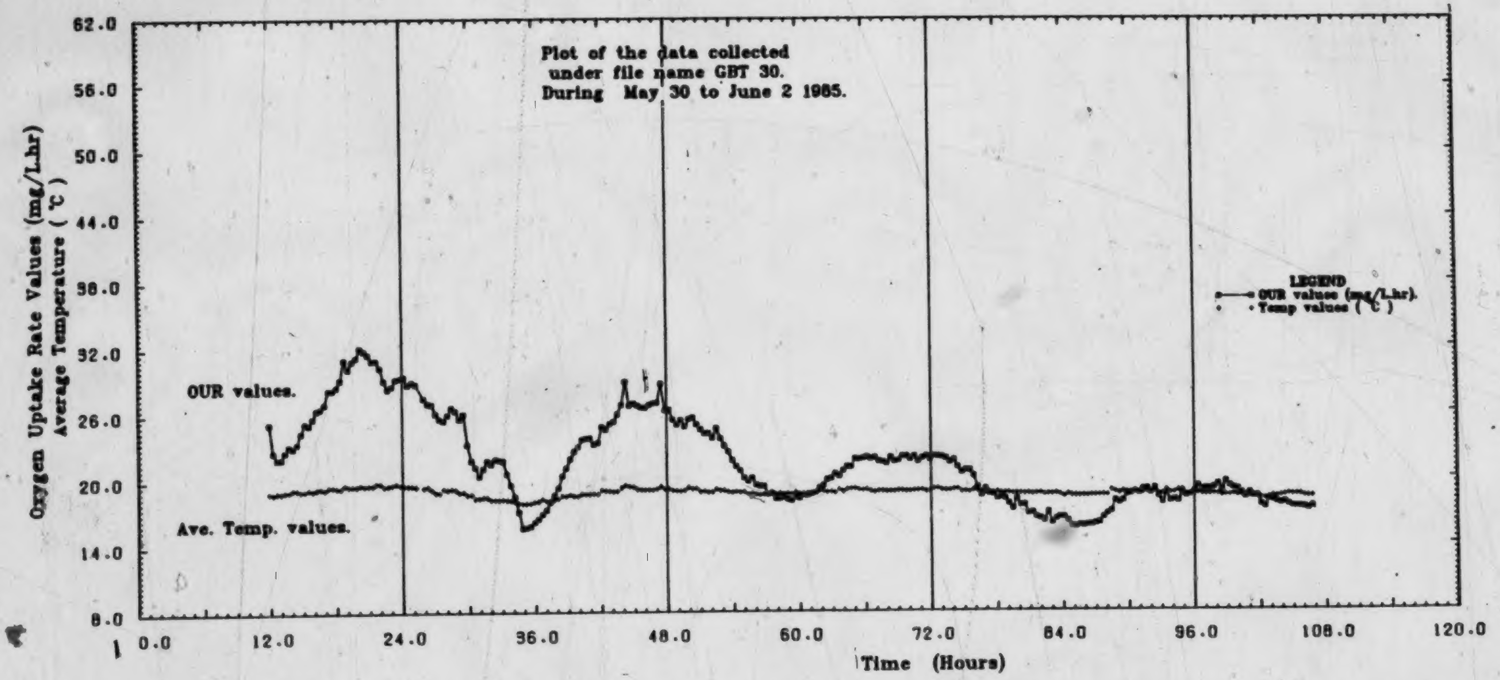
These data were collected under file OBT#30

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of June 3 1985)

DAY :5 3 4 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0:19	19.29	18.6
0:41	18.87	18.5
1: 2	19.04	18.5
1:25	19.02	18.5
1:46	19.15	18.6
2: 7	19.45	18.5
2:29	18.94	18.4
2:50	18.88	18.5
3:12	19.29	18.5
3:33	19.08	18.6
3:55	19.00	18.4
4:17	18.67	18.4
4:38	18.26	18.4
5: 0	18.85	18.4
5:21	18.32	18.4
5:43	18.35	18.3
6: 4	17.57	18.2
6:26	17.34	18.1
6:47	18.04	18.2
7: 9	17.96	18.4
7:31	17.80	18.3
7:52	17.88	18.4
8:14	17.78	18.5
8:35	17.56	18.6
8:57	17.39	18.5
9:18	17.38	18.5
9:40	17.37	18.5
10: 2	17.31	18.4
10:23	17.18	18.3
10:45	17.40	18.3

These data were collected under file GBT#30

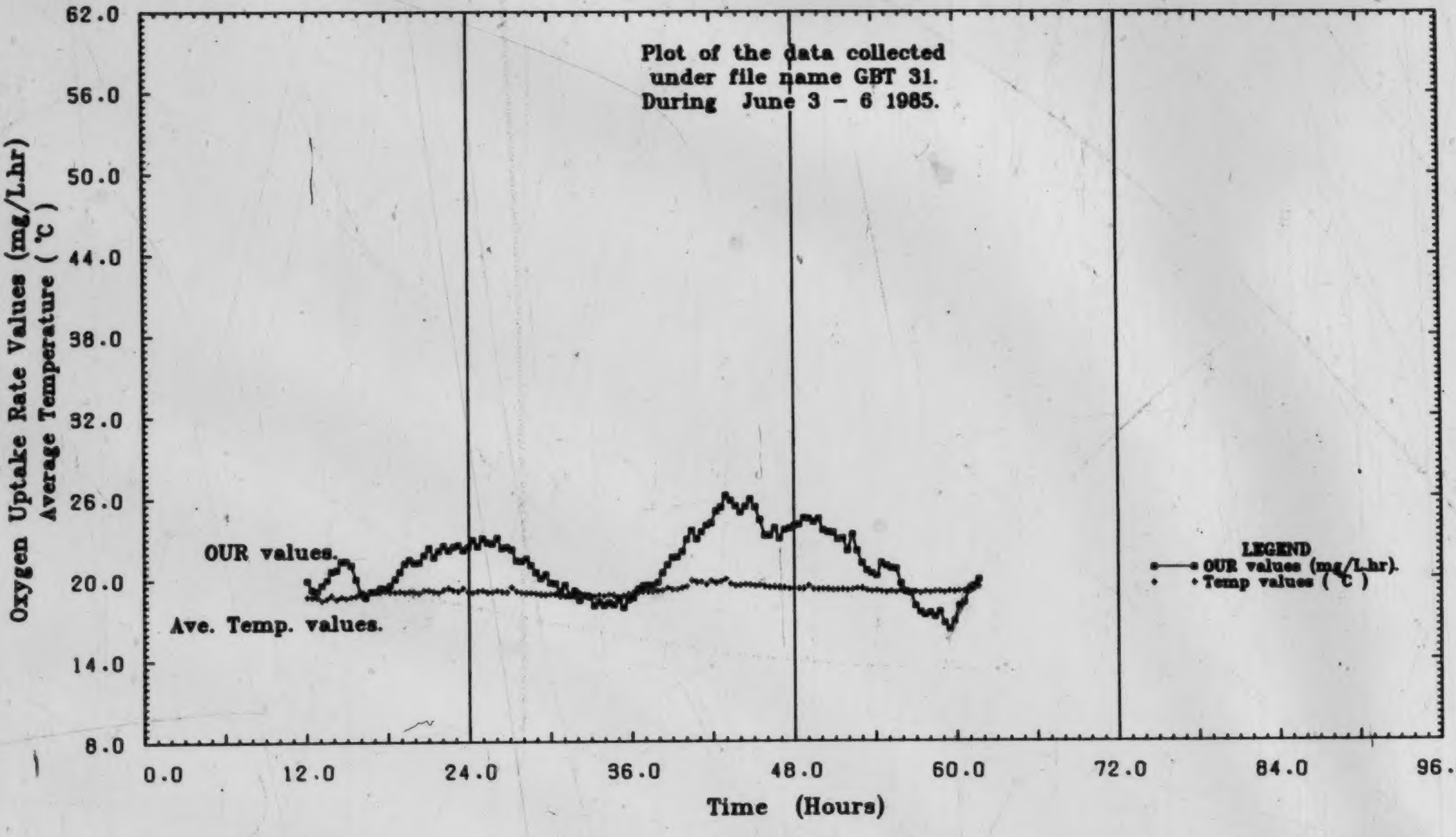


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 3- 5 / 5 / 1985)

DAY 1			DAY 2			DAY 3		
3 5 85			4 5 85			5 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:15	22.94	19.1	0:20	24.00	19.3
			0:37	22.48	19.2	0:41	24.47	19.2
			1: 0	23.05	19.2	1: 3	24.43	19.5
			1:20	22.75	19.1	1:25	24.18	19.2
			1:42	22.68	19.1	1:46	24.43	19.2
			2: 3	23.08	19.2	2: 7	23.58	19.2
			2:25	22.32	19.1	2:29	23.44	19.2
			2:46	22.41	19.1	2:51	23.38	19.2
			3: 8	22.22	19.4	3:12	22.91	19.2
			3:29	21.40	19.1	3:34	22.98	19.2
			3:50	21.37	19.0	3:55	22.07	19.1
			4:12	21.53	19.0	4:17	23.24	19.2
			4:33	21.05	19.0	4:38	22.05	19.3
			4:55	20.53	19.0	5: 0	21.14	19.2
			5:17	20.08	18.9	5:22	20.59	19.1
			5:38	20.37	18.9	5:43	20.39	19.1
			6: 0	19.74	18.8	6: 5	20.21	19.1
			6:21	19.59	18.9	6:26	21.18	19.0
			6:43	19.12	18.8	6:48	20.94	19.0
			7: 4	18.58	18.8	7: 9	20.78	19.1
			7:26	18.80	18.8	7:31	20.72	19.0
			7:47	19.16	18.8	7:52	19.62	19.1
			8: 9	18.44	19.0	8:14	19.02	19.0
			8:31	18.78	18.8	8:35	18.92	19.0
			8:52	18.70	18.9	8:57	17.97	19.0
			9:14	18.02	18.7	9:18	17.51	18.9
			9:35	18.29	18.8	9:40	17.31	19.0
			9:57	18.04	18.8	10: 2	17.45	19.0
			10:18	18.24	18.9	10:23	17.18	19.0
			10:40	18.08	18.8	10:45	17.53	19.0
			11: 2	18.47	18.7	11: 6	16.70	19.0
			11:23	17.89	18.8	11:28	18.25	19.1
			11:45	18.45	18.9	11:50	16.85	19.0
			12: 6	18.61	19.0	12:11	17.98	19.1
12: 2	19.97	18.8	12:28	19.26	19.0	12:33	18.21	19.1
12:25	19.27	18.7	12:50	19.50	19.1	12:54	19.09	19.3
12:46	19.16	18.7	13:11	19.55	19.1	13:16	19.46	19.2
13: 7	19.82	18.5	13:32	19.52	19.1	13:38	19.91	19.4
13:29	20.01	18.6	13:54	19.75	19.1			
13:50	20.64	18.9	14:15	20.45	19.2			
14:12	20.75	18.8	14:37	21.06	19.3			
14:34	21.39	18.8	15: 0	21.59	19.2			
14:55	21.39	18.7	15:20	21.63	19.2			
15:17	21.11	18.8	15:42	22.01	19.3			
15:38	20.07	18.8	16: 3	22.90	19.4			
16: 0	19.06	18.9	16:25	23.57	19.5			
16:21	18.71	19.0	16:47	22.94	19.7			
16:43	19.14	19.1	17: 8	23.46	19.6			
17: 4	19.15	19.1	17:30	23.85	19.6			
17:26	19.43	19.1	17:51	24.12	19.8			
17:48	19.34	19.2	18:13	24.89	19.7			
18: 9	19.58	19.1	18:35	25.28	19.8			
18:31	20.06	19.1	18:56	26.14	20.0			
18:52	20.60	19.2	19:18	25.79	19.8			
19:14	21.22	19.1	19:40	25.37	19.5			
19:35	21.51	19.1	20: 1	24.90	19.6			
19:57	21.27	19.1	20:23	26.34	19.6			
20:18	21.30	19.0	20:44	25.66	19.5			
20:40	21.63	19.2	21: 6	25.29	19.5			
21: 1	22.36	19.2	21:27	24.34	19.5			
21:23	21.88	19.1	21:50	23.20	19.4			
21:44	22.14	19.1	22:10	23.20	19.4			
22: 6	22.52	19.3	22:32	23.75	19.4			
22:28	22.17	19.4	22:54	22.98	19.3			
22:50	22.45	19.2	23:15	23.61	19.3			
23:11	22.57	19.2	23:37	23.71	19.3			
23:32	22.20	19.4	23:58	23.91	19.3			
23:54	22.41	19.1						

These data were collected under file GBT#31



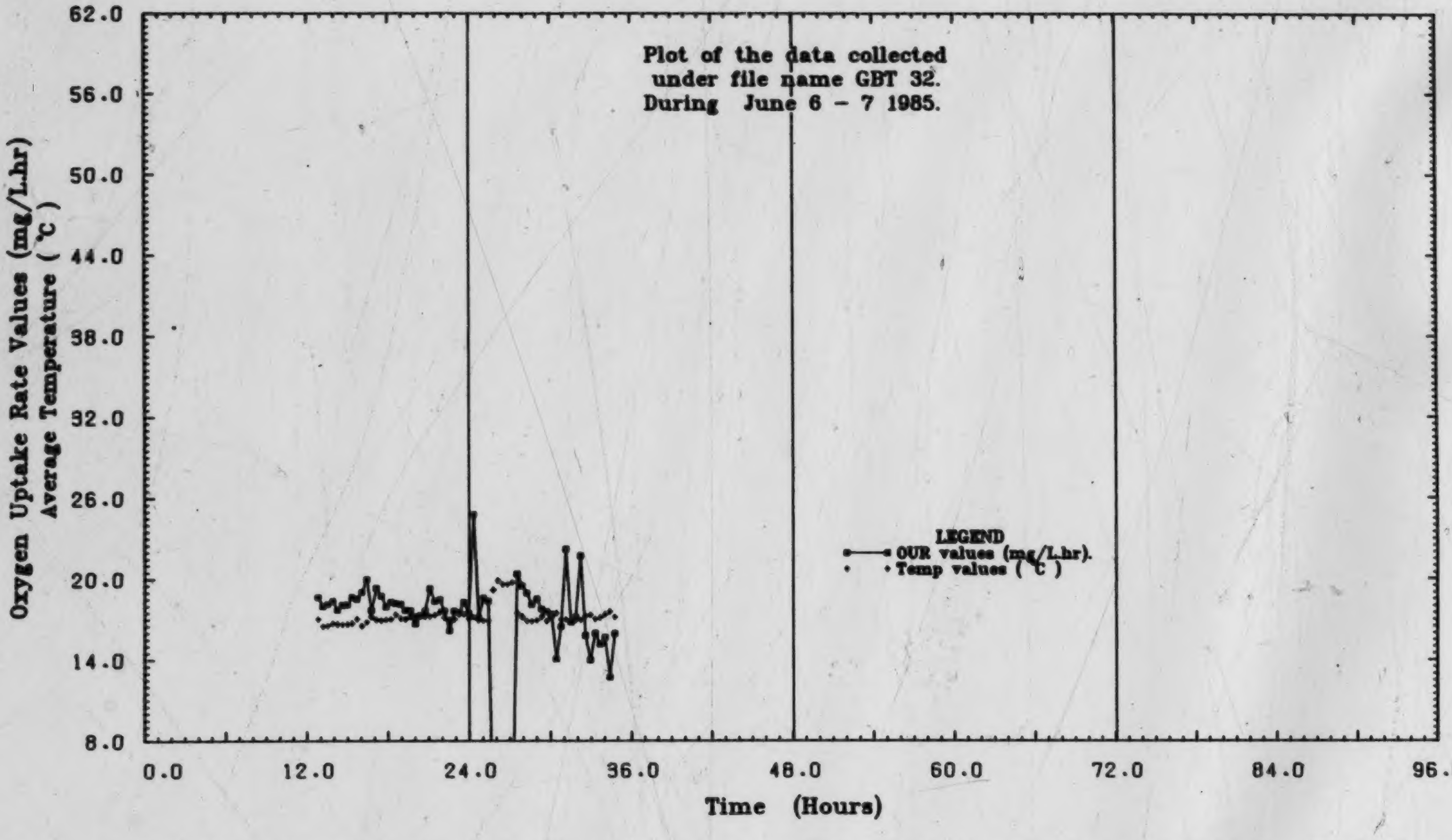
Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.

(For the period of 6- 7 / 6 / 1988)

DAY 1			DAY 2		
6 6 88			7 6 88		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:18	24.78	17.2
			0:40	17.12	17.0
			1: 2	18.58	16.8
			1:23	18.36	16.9
			1:45	-1.10	16.2
			2: 6	2.88	16.9
			2:28	-1.15	16.6
			2:50	-2.27	16.6
			3:11	3.73	16.6
			3:32	20.36	17.5
			3:54	18.48	17.2
			4:15	15.85	16.9
			4:37	18.13	16.9
			5: 0	18.52	17.0
			5:20	17.78	17.2
			5:42	17.58	16.9
			6: 3	17.39	17.1
			6:25	14.07	17.5
			6:46	18.48	17.0
			7: 8	22.22	17.0
			7:30	16.62	16.8
			7:51	17.19	17.0
			8:13	21.73	17.0
			8:34	18.80	17.2
			8:56	13.99	17.3
			9:17	15.99	17.0
			9:38	15.16	17.1
			10: 1	15.66	17.4
			10:22	12.71	17.5
			10:44	15.85	17.2
12:48	15.85	17.0			
13:10	16.00	16.5			
13:31	16.15	16.6			
13:53	16.37	16.7			
14:14	17.72	16.7			
14:36	16.08	16.7			
14:58	16.12	16.7			
15:19	16.57	16.7			
15:41	16.52	17.1			
16: 2	19.03	16.8			
16:25	19.99	16.8			
16:45	17.58	17.2			
17: 7	19.33	17.0			
17:28	16.75	16.8			
17:50	17.96	17.0			
18:12	16.30	17.0			
18:33	16.20	17.4			
18:55	16.15	17.1			
19:16	17.69	17.0			
19:38	17.57	17.2			
20: 0	16.70	17.3			
20:21	17.31	17.2			
20:43	17.86	17.2			
21: 4	19.30	17.3			
21:25	16.36	17.3			
21:47	16.46	17.5			
22: 9	17.63	17.1			
22:31	16.17	17.0			
22:52	17.62	17.0			
23:14	17.51	17.4			
23:35	16.27	17.4			
23:57	17.47	17.1			

These data were collected under file GST#33



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 9- 10 / 8 / 1985)

DAY 1 9 8 85			DAY 2 10 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 1	26.43	18.5
			0:22	26.80	18.5
			0:44	26.57	18.5
			1: 5	26.70	18.6
			1:27	26.83	18.5
			1:48	29.08	18.5
			2:10	29.21	18.5
			2:32	26.64	18.5
			2:53	26.82	18.3
			3:15	27.85	18.3
			3:36	27.65	18.1
			3:58	26.78	18.2
			4:19	26.72	18.2
			4:40	26.24	18.1
			5: 2	26.34	18.3
			5:25	26.29	18.1
			5:46	26.01	18.1
			6: 7	25.51	18.1
			6:28	26.11	18.0
			6:50	25.47	18.3
			7:11	25.19	18.1
			7:33	25.36	18.1
			7:55	25.26	18.1
			8:16	25.39	18.2
			8:38	25.09	18.1
			9: 0	25.06	18.1
			9:21	24.84	18.3
			9:42	25.39	18.2
			10: 4	25.53	18.2
			10:26	25.46	18.3
			10:47	25.87	18.1
			11: 9	26.29	18.2
			11:30	25.98	18.2
			11:52	26.13	18.1
			12:13	26.54	18.3
			12:35	26.52	18.4
			12:56	26.84	18.5
			13:18	27.04	18.4
			13:40	27.16	18.3
			14: 1	27.14	18.2
14:19	25.52	18.4	14:23	27.86	18.4
14:40	25.11	18.3	14:44	28.24	18.5
15: 2	25.63	18.5	15: 6	28.52	18.5
15:23	25.57	18.5	15:27	27.18	18.6
15:45	25.60	18.5	15:50	27.39	18.6
16: 6	26.28	18.6	16:11	29.98	18.4
16:28	25.71	18.6	16:32	0.06	20.0
16:50	26.61	18.4	16:54	0.89	21.6
17:11	26.75	18.7			
17:33	26.75	18.4			
17:54	26.45	18.3			
18:16	26.90	18.4			
18:37	26.95	18.4			
19: 0	27.60	18.6			
19:21	27.62	18.4			
19:42	27.36	18.4			
20: 4	27.34	18.5			
20:25	27.63	18.5			
20:47	27.61	18.5			
21: 8	27.99	18.6			
21:30	27.72	18.5			
21:51	27.66	18.4			
22:13	28.12	18.6			
22:34	28.10	18.5			
22:56	27.75	18.5			
23:18	28.36	18.7			
23:39	28.71	18.7			

These data were collected under file GBT#33

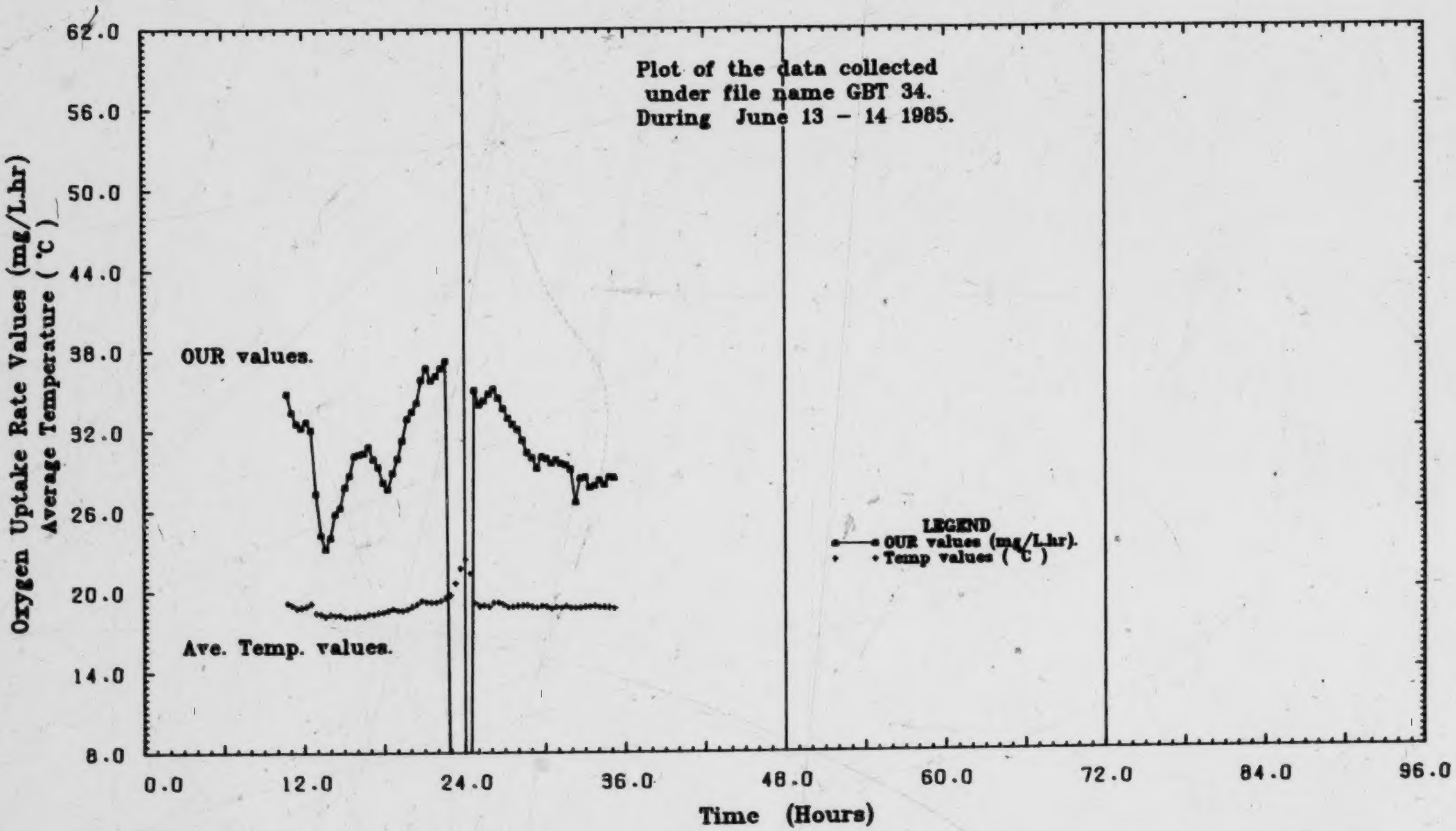
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 13-14 / 6 / 1985)

DAY 1 13 6 85			DAY 2 14 6 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 0	-0.36	22.4
			0:22	0.72	21.4
			0:43	35.06	19.2
			1: 5	34.00	18.9
			1:26	34.29	19.0
			1:48	34.82	18.9
			2: 9	35.16	19.2
			2:31	34.61	19.2
			2:52	33.72	19.1
			3:14	33.00	18.9
			3:35	32.52	18.9
			3:57	32.16	19.0
			4:18	31.33	19.0
			4:40	30.42	19.0
			5: 2	30.03	18.9
			5:23	29.26	18.8
			5:45	30.10	19.0
			6: 6	29.86	18.9
			6:28	29.63	18.8
			6:50	29.88	18.9
			7:11	29.60	18.8
			7:33	29.50	18.9
			7:54	29.16	18.8
			8:16	28.74	18.8
			8:37	28.50	18.8
			9: 0	28.56	18.9
			9:20	27.82	18.9
			9:42	27.98	18.9
			10: 3	28.38	18.9
			10:25	28.04	18.8
10:43	34.83	19.2	10:46	28.60	18.8
11: 4	33.45	19.1	11: 8	28.53	18.8
11:26	32.60	18.8			
11:47	32.26	18.9			
12: 9	32.74	19.0			
12:30	32.12	19.2			
12:52	27.36	18.5			
13:14	24.28	18.4			
13:35	23.23	18.2			
13:57	24.06	18.4			
14:18	26.85	18.3			
14:40	26.32	18.3			
15: 2	27.86	18.1			
15:23	28.72	18.2			
15:45	30.19	18.2			
16: 6	30.30	18.3			
16:28	30.39	18.2			
16:50	30.65	18.4			
17:11	29.93	18.4			
17:32	29.35	18.4			
17:54	28.20	18.5			
18:15	27.70	18.6			
18:37	28.60	18.6			
19: 0	29.97	18.7			
19:20	31.32	18.6			
19:42	32.94	18.7			
20: 3	33.48	18.9			
20:25	34.15	19.1			
20:46	35.85	19.4			
21: 7	36.73	19.3			
21:29	35.82	19.2			
21:51	36.13	19.2			
22:12	36.73	19.4			
22:34	37.27	19.6			
22:56	-1.63	19.6			
23:17	0.71	20.7			
23:38	1.04	21.6			

These data were collected under file SBT#34



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 14-17 / 6 / 1985)

DAY 1			DAY 2			DAY 3			DAY 4		
14 6 85			15 6 85			16 6 85			17 6 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 4	34.86	19.2	0: 9	32.14	17.0	0:14	39.53	18.2
			0:26	34.49	19.0	0:30	32.26	17.0	0:36	39.39	18.2
			0:47	34.79	19.0	0:52	32.17	17.0	0:57	39.78	18.1
			1: 9	34.83	19.0	1:13	31.70	17.0	1:19	40.50	18.1
			1:30	33.85	18.8	1:35	31.72	17.0	1:40	39.21	18.2
			1:52	33.19	18.9	1:57	31.66	17.1	2: 2	39.72	18.0
			2:13	33.87	18.9	2:18	31.64	17.2	2:23	40.46	18.1
			2:35	34.13	18.9	2:40	31.76	17.3	2:45	40.02	18.3
			2:56	33.59	18.9	3: 1	31.51	17.0	3: 6	39.42	18.1
			3:18	33.47	18.9	3:23	31.46	17.0	3:28	39.23	18.0
			3:40	33.25	18.8	3:44	31.28	17.0	3:50	38.54	18.1
			4: 1	32.81	18.7	4: 6	31.16	17.0	4:11	38.73	18.0
			4:23	31.54	18.7	4:28	31.53	16.9	4:33	38.55	18.0
			4:44	31.26	18.6	4:50	31.19	16.9	4:54	37.61	18.2
			5: 6	30.82	18.7	5:11	31.10	16.9	5:16	38.93	18.0
			5:27	30.52	18.7	5:32	30.43	16.8	5:37	37.01	18.0
			5:50	31.32	18.8	5:54	30.42	17.0	6: 0	36.88	17.9
			6:10	30.86	18.6	6:15	30.30	16.9	6:20	37.66	18.1
			6:32	31.20	18.7	6:37	29.46	17.0	6:42	37.25	18.1
			6:53	31.36	18.7	7: 0	29.57	17.0	7: 3	36.80	18.1
			7:15	31.30	18.7	7:20	28.64	17.0	7:25	36.96	18.1
			7:37	31.29	18.6	7:42	29.03	17.0	7:47	38.17	18.2
			7:58	31.58	18.5	8: 3	29.39	16.9	8: 8	36.31	18.1
			8:20	31.01	18.5	8:25	29.32	16.9	8:30	36.35	18.0
			8:41	30.92	18.6	8:47	29.16	16.8	8:51	36.99	18.1
			9: 3	29.99	18.5	9: 8	29.29	17.0	9:13	36.33	18.1
			9:25	27.46	18.5	9:30	29.30	17.0	9:34	36.49	18.1
			9:46	28.11	18.4	9:51	30.15	17.3	9:56	37.10	18.1
			10: 8	27.61	18.2	10:13	30.35	17.5	10:17	37.65	18.0
			10:29	28.29	18.2	10:34	30.33	17.5	10:39	37.68	18.1
			10:51	29.94	18.1	10:56	30.61	17.7	11: 0	39.00	18.1
			11:12	30.00	18.2	11:18	30.65	17.8	11:22	39.29	18.3
11:51	30.47	18.1	11:34	30.57	17.9	11:39	31.22	17.6	11:44	39.05	18.3
12:13	30.59	18.9	11:56	30.32	17.9	12: 1	30.99	17.6	12: 5	40.29	18.4
12:34	30.72	19.0	12:17	30.07	17.8	12:23	31.21	17.6	12:27	40.75	18.5
12:56	30.90	19.0	12:39	30.06	17.8	12:44	31.28	17.6	12:48	41.61	18.5
13:17	31.20	18.9	13: 0	30.39	17.8	13: 6	31.72	17.6	13:10	42.30	18.5
13:39	30.91	19.0	13:22	31.02	17.9	13:27	31.65	17.6	13:31	41.84	18.6
14: 1	31.45	19.1	13:44	30.16	17.7	13:50	32.19	17.6	13:53	42.67	18.6
14:22	31.51	19.2	14: 5	30.20	17.7	14:10	32.36	17.7	14:15	43.18	18.7
14:44	32.07	19.3	14:27	29.50	17.6	14:32	32.85	17.7	14:36	44.00	18.8
15: 5	32.12	19.3	14:48	28.84	17.6	14:54	33.19	17.9	14:58	44.60	19.0
15:27	33.25	19.3	15:10	28.39	17.4	15:15	33.29	17.8	15:19	45.94	19.0
15:48	33.19	19.4	15:31	27.89	17.3	15:37	33.51	17.8	15:41	46.20	18.9
16:10	33.29	19.3	15:53	27.82	17.2	15:58	33.4[illegible]	17.7	16: 2	47.42	19.2
16:32	33.60	19.2	16:14	27.31	17.1	16:20	34.60	17.8	16:25	47.88	19.3
16:53	34.73	19.4	16:36	27.65	17.0	16:41	34.57	17.9	16:46	48.22	19.2
17:15	35.05	19.5	16:57	28.07	17.1	17: 3	34.63	17.8	17: 7	48.62	19.2
17:36	36.05	19.5	17:19	28.25	16.9	17:25	34.79	17.9	17:28	49.77	19.2
17:58	37.01	19.5	17:41	28.83	16.8	17:46	35.24	17.9	17:50	50.69	19.2
18:19	37.73	19.6	18: 2	29.07	16.8	18: 8	35.41	18.0	18:12	14.10	19.7
18:41	38.51	19.6	18:25	29.58	16.9	18:29	35.84	17.8	18:33	0.07	20.8
19: 2	38.31	19.7	18:45	30.67	17.0	18:51	35.64	17.8	18:55	0.90	20.7
19:25	39.33	19.6	19: 7	30.46	16.9	19:12	36.00	17.9	19:16	0.13	20.7
19:46	40.77	19.6	19:28	30.38	17.1	19:34	36.74	17.8	19:38	1.48	22.5
20: 7	42.65	19.4	19:50	30.14	16.9	19:55	36.77	17.8	20: 0	1.58	11.9
20:28	43.72	19.3	20:12	30.04	17.0	20:17	36.87	18.0			
20:50	42.12	19.6	20:33	29.77	16.9	20:39	37.34	18.1			
21:12	41.15	19.5	20:55	29.64	16.9	21: 0	37.31	18.0			
21:33	40.17	19.6	21:16	29.06	16.9	21:22	37.03	18.1			
21:55	40.51	19.6	21:38	29.74	16.9	21:43	38.28	18.1			
22:16	41.03	19.5	22: 0	29.86	17.0	22: 5	38.44	18.1			
22:38	39.94	19.5	22:21	31.26	17.2	22:26	38.02	18.1			
23: 0	38.62	19.4	22:42	31.87	17.3	22:48	37.79	18.1			
23:21	36.94	19.3	23: 4	32.20	17.0	23: 9	38.31	18.1			
23:42	35.46	19.2	23:26	32.51	17.0	23:31	38.49	18.1			

These data were collected under file name GBT#35

The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 18-20 / 6 / 1985)

DAY 1			DAY 2			DAY 3		
18 6 85			19 6 85			20 6 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 0	38.88	20.4	0: 3	37.15	20.2
			0:20	38.87	20.3	0:25	38.41	20.3
			0:42	37.78	20.3	0:46	37.32	20.3
			1: 3	37.88	20.3	1: 7	35.54	20.2
			1:25	38.16	20.2	1:29	35.89	20.1
			1:46	38.57	20.2	1:51	35.28	20.1
			2: 8	37.86	20.2	2:12	34.90	20.2
			2:30	-1.07	20.9	2:34	35.57	20.1
			2:51	37.82	20.1	2:55	34.47	20.0
			3:13	38.23	20.1	3:17	34.87	20.1
			3:34	-0.71	21.4	3:38	35.14	20.1
			3:56	37.33	20.3	4: 0	34.75	20.1
			4:17	34.47	20.3	4:22	33.38	20.2
			4:39	35.99	20.1	4:43	25.41	20.2
			5: 0	34.58	20.2	5: 5	0.10	21.8
			5:22	34.19	20.1	5:26	32.55	20.1
			5:43	34.43	20.0	5:48	30.94	20.0
			6: 5	34.07	20.0	6: 9	31.29	19.9
			6:27	33.98	20.1	6:31	30.90	19.8
			6:48	33.82	20.2	6:52	30.58	19.7
			7:10	33.81	19.9	7:14	30.60	19.6
			7:31	34.05	20.0	7:35	30.90	19.5
			7:53	33.12	20.2	7:57	30.18	19.5
			8:14	33.24	20.0	8:18	29.97	19.3
			8:36	33.20	19.9	8:40	30.02	19.3
			8:57	32.70	19.8	9: 2	29.83	19.3
			9:19	32.47	19.7	9:23	29.65	19.3
			9:41	32.09	19.6	9:45	28.91	19.3
			10: 2	31.22	19.5	10: 6	28.84	19.3
			10:25	31.13	19.4	10:28	28.55	19.4
			10:45	31.98	19.6	10:50	28.48	19.2
			11: 7	32.09	19.6	11:11	28.60	19.1
			11:28	33.46	19.6	11:33	28.82	19.1
			11:50	33.70	19.6	11:54	29.19	19.1
			12:11	34.29	19.8	12:16	30.31	19.3
			12:33	34.56	19.7	12:38	30.97	19.3
			12:54	35.32	19.7	13: 0	31.10	19.3
			13:16	35.07	19.8	13:21	32.00	19.2
			13:38	35.12	19.9	13:42	32.41	19.4
			14: 0	34.48	20.1	14: 4	31.81	19.6
			14:21	34.64	19.9	14:25	32.03	19.5
			14:42	34.84	20.0	14:47	32.35	19.5
			15: 4	35.04	19.9	15: 9	32.24	19.[illegible]
			15:25	35.34	20.0			
			15:47	35.57	20.2			
			16: 8	36.10	20.1			
			16:30	36.10	20.2			
			16:52	36.71	20.2			
			17:13	37.90	20.3			
17: 9	36.65	19.7	17:35	36.98	20.1			
17:31	36.81	19.7	17:56	37.40	20.4			
17:52	37.07	19.9	18:18	37.34	20.3			
18:14	36.73	19.9	18:39	37.37	20.5			
18:35	35.55	20.0	19: 1	36.87	20.3			
18:57	37.38	20.1	19:23	36.66	20.2			
19:18	37.98	20.2	19:44	37.06	20.3			
19:40	38.46	20.0	20: 6	36.85	20.4			
20: 2	39.02	20.2	20:27	36.73	20.4			
20.23	39.77	20.3	20:50	38.05	20.4			
20:45	0.47	20.9	21:10	38.74	20.6			
21: 6	1.22	12.0	21:32	38.37	20.4			
21:28	40.34	20.5	21:53	40.89	20.4			
21:50	39.75	20.3	22:15	41.93	20.4			
22:11	39.51	20.4	22:37	42.74	20.5			
22:32	39.01	20.4	22:58	41.08	20.4			
22:54	38.27	20.4	23:20	40.57	20.2			
23:16	37.93	20.3	23:41	38.85	20.3			
23:37	38.15	20.2	0: 3	37.16	20.2			

These data were collected under file GBT#36

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 20-21 / 8 / 1985)

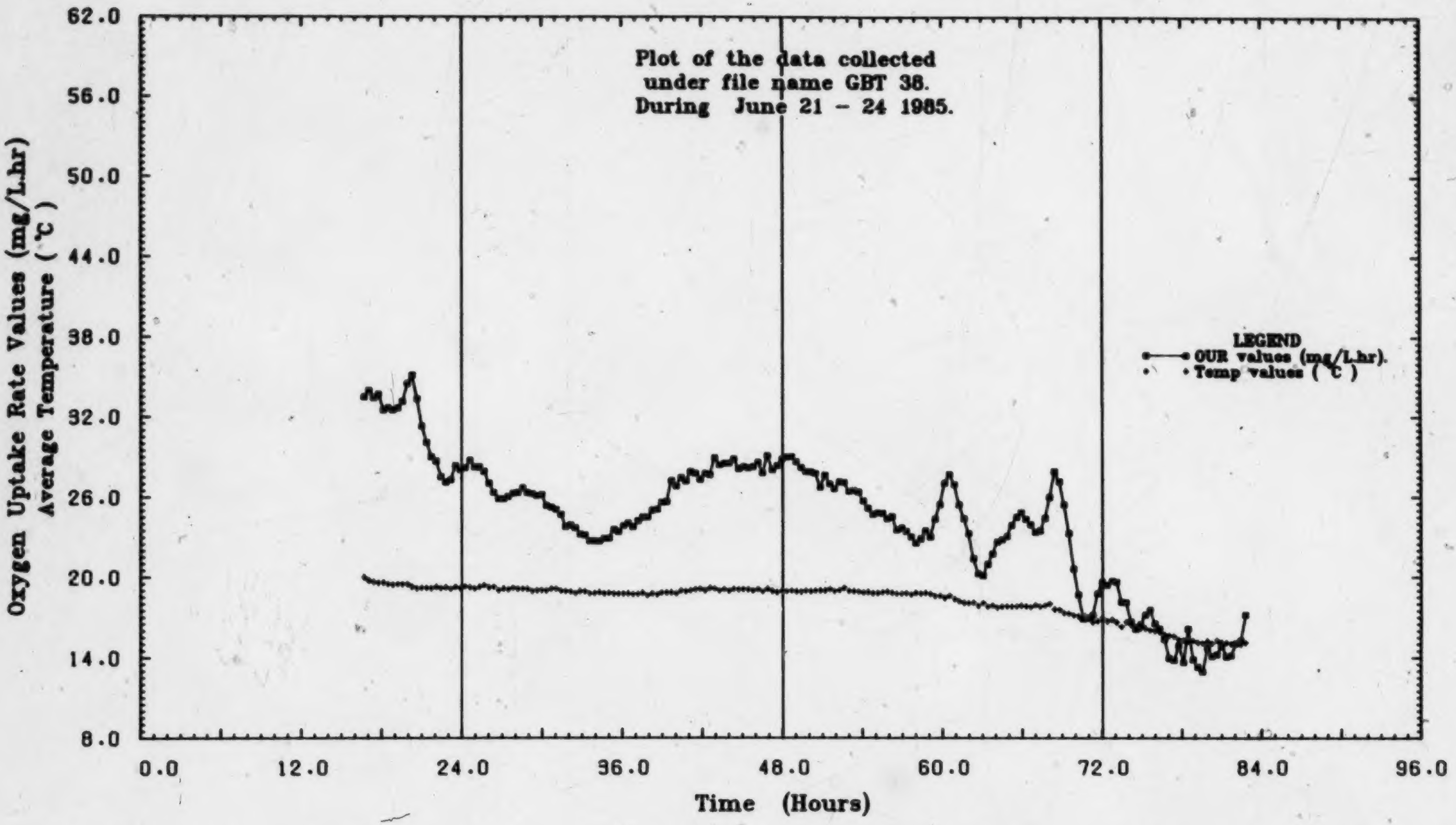
DAY 1			DAY 2		
20 8 85			21 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:12	30.06	19.5
			0:33	29.34	19.4
			0:55	1.59	18.4
			1:16	29.94	19.5
			1:38	29.27	19.4
			2: 0	29.71	19.3
			2:21	30.29	19.4
			2:43	30.25	19.5
			3: 4	30.14	19.2
			3:26	30.01	19.3
			3:47	29.73	19.6
			4: 9	29.65	19.5
			4:30	24.98	19.4
			4:52	28.01	19.3
			5:13	27.40	19.4
			5:35	27.04	19.4
			5:56	26.89	19.3
			6:18	26.59	19.2
			6:40	26.51	19.3
			7: 1	26.56	19.2
			7:23	26.12	19.2
			7:44	25.52	19.2
			8: 6	25.61	19.2
			8:27	26.63	19.2
			8:50	26.34	19.3
			9:10	26.03	19.2
			9:32	26.38	19.4
			9:54	26.07	19.3
			10:15	25.26	18.9
			10:37	25.03	18.8
			10:58	25.06	18.8
			11:20	25.36	18.8
			11:41	26.38	19.1
			12: 3	26.66	19.0
			12:25	27.54	18.9
			12:46	27.36	19.0
			13: 7	27.50	19.1
			13:29	27.66	19.1
			13:51	27.51	19.1
			14:12	27.57	19.2
			14:34	27.32	19.3
			14:55	27.66	19.2
16:18	34.69	20.4			
16:39	35.27	20.2			
17: 1	34.22	20.0			
17:22	35.05	20.2			
17:44	35.90	20.2			
18: 5	36.53	20.2			
18:27	36.53	20.1			
18:48	37.44	20.2			
19:10	35.85	20.0			
19:31	33.66	19.7			
19:53	32.25	19.6			
20:15	30.97	19.5			
20:36	30.53	19.5			
20:58	29.99	19.4			
21:19	30.12	19.4			
21:41	30.16	19.5			
22: 2	30.49	19.3			
22:25	31.28	19.4			
22:46	31.60	19.3			
23: 7	31.57	19.5			
23:29	31.03	19.3			
23:50	29.98	19.3			

These data were collected under file SBT#37

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 21-24 / 8 / 1985)

DAY 1			DAY 2			DAY 3			DAY 4		
21 8 85			22 8 85			23 8 85			24 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:13	28.23	19.4	0:16	29.00	19.0	0:19	18.44	16.7
			0:35	28.75	19.3	0:38	29.02	19.0	0:41	18.75	16.8
			0:56	28.30	19.2	1: 0	28.85	18.8	1: 2	18.87	16.7
			1:18	28.29	19.3	1:21	28.21	18.9	1:25	18.17	16.3
			1:39	27.94	19.5	1:42	27.91	19.0	1:45	18.14	16.7
			2: 1	27.07	19.3	2: 4	27.89	18.9	2: 7	18.71	16.8
			2:22	26.36	19.3	2:25	27.79	19.0	2:29	18.15	16.4
			2:44	25.90	19.1	2:47	28.75	19.0	2:50	18.53	16.2
			3: 5	25.88	19.2	3: 8	27.87	19.0	3:12	17.22	16.2
			3:27	26.08	19.1	3:30	27.00	19.1	3:33	17.58	16.1
			3:50	26.33	19.3	3:51	26.84	19.0	3:55	16.58	16.0
			4:10	26.37	19.2	4:13	27.15	19.0	4:16	16.16	16.0
			4:32	26.73	19.2	4:34	27.10	19.2	4:38	15.40	15.8
			4:53	26.36	19.2	4:56	26.43	19.0	5: 0	13.99	15.7
			5:15	26.28	19.0	5:18	26.49	18.9	5:21	13.85	15.8
			5:36	26.14	19.1	5:39	26.39	18.9	5:42	14.94	15.4
			5:58	26.20	19.1	6: 1	25.72	18.8	6: 4	13.69	15.4
			6:19	25.40	19.1	6:22	25.17	18.9	6:26	15.17	15.3
			6:41	25.25	19.2	6:44	24.73	18.8	6:47	13.66	15.3
			7: 2	25.10	19.2	7: 5	24.82	18.8	7: 9	13.33	15.2
			7:25	24.73	19.0	7:27	24.81	18.8	7:30	12.98	15.1
			7:45	23.82	19.0	7:48	24.40	18.9	7:52	14.73	15.3
			8: 7	23.84	19.0	8:10	24.56	18.8	8:13	14.13	15.1
			8:28	23.74	18.9	8:31	23.57	18.8	8:35	14.25	15.3
			8:50	23.26	19.0	8:53	23.70	18.6	8:56	14.87	15.2
			9:12	23.19	19.0	9:14	23.45	18.6	9:18	14.10	15.2
			9:33	22.75	18.8	9:36	23.04	18.7	9:39	14.16	15.1
			9:55	22.75	18.8	9:57	22.59	18.8	10: 1	15.10	15.1
			10:16	22.73	18.9	10:19	22.80	18.8	10:23	15.25	15.0
			10:38	22.83	18.8	10:40	23.50	18.8	10:44	17.22	15.3
			11: 0	22.94	18.9	11: 2	23.05	18.8			
			11:21	23.60	18.8	11:23	24.37	18.6			
			11:42	23.44	18.8	11:45	25.46	18.5			
			12: 4	23.89	18.8	12: 6	27.07	18.5			
			12:25	24.07	18.8	12:28	27.70	18.5			
			12:47	23.81	18.8	12:50	26.95	18.4			
			13: 8	24.23	18.8	13:11	25.45	18.2			
			13:30	24.51	18.8	13:33	24.40	18.1			
			13:52	24.51	18.7	13:54	23.29	18.1			
			14:13	25.03	18.8	14:16	21.41	18.1			
			14:35	25.08	18.7	14:37	20.28	17.9			
			14:56	25.81	18.9	15: 0	20.13	18.1			
			15:18	25.66	18.9	15:20	20.99	17.8			
			15:39	27.23	18.9	15:42	21.77	17.9			
			16: 1	26.84	18.8	16: 3	22.57	17.8			
16:41	33.51	20.0	16:22	27.48	19.0	16:25	22.83	17.8			
17: 2	34.00	19.8	16:44	27.21	19.0	16:47	23.08	17.8			
17:25	33.45	19.7	17: 5	27.88	19.0	17: 8	23.81	17.8			
17:45	33.72	19.6	17:27	27.78	19.1	17:30	24.52	17.8			
18: 7	32.54	19.6	17:48	27.32	19.1	17:51	24.66	17.9			
18:28	32.69	19.5	18:10	27.77	19.0	18:13	24.37	17.9			
18:50	32.53	19.5	18:32	27.68	19.2	18:34	23.97	17.8			
19:12	32.66	19.5	18:53	28.03	19.2	18:56	23.62	18.0			
19:33	33.16	19.5	19:15	28.42	19.0	19:17	23.52	17.8			
19:55	34.51	19.5	19:36	28.53	19.1	19:39	24.46	17.9			
20:16	35.15	19.3	19:58	28.54	19.0	20: 0	26.02	18.0			
20:38	33.36	19.2	20:19	28.84	19.1	20:22	27.94	17.8			
21: 0	31.33	19.3	20:41	28.13	19.1	20:44	27.18	17.8			
21:21	30.11	19.3	21: 2	28.28	19.1	21: 5	25.46	17.4			
21:42	29.04	19.2	21:25	28.19	19.1	21:27	23.33	17.3			
22: 4	28.71	19.3	21:45	28.27	19.0	21:48	20.64	17.2			
22:25	27.88	19.2	22: 7	28.59	19.1	22:10	18.71	17.1			
22:47	27.15	19.3	22:28	27.52	19.0	22:31	16.92	17.1			
23: 9	27.33	19.2	22:50	29.09	19.1	22:53	17.00	16.9			
23:30	28.37	19.3	23:12	28.04	19.0	23:14	17.20	16.7			
23:52	28.08	19.2	23:33	28.36	18.9	23:36	18.80	16.6			

These data were collected under file GBT#38



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 24-26 / 6 / 1985)

DAY 1 24 6 85			DAY 2 25 6 85			DAY 3 26 6 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:17	31.81	17.6	0:19	36.45	18.6
			0:38	31.77	17.6	0:41	36.82	18.7
			1: 0	31.38	17.6	1: 2	37.79	18.8
			1:21	30.97	17.7	1:25	38.19	18.6
			1:43	31.02	17.7	1:45	37.62	18.9
			2: 4	30.41	17.6	2: 7	36.61	18.6
			2:26	30.69	17.7	2:28	37.16	18.6
			2:47	29.58	17.5	2:50	36.58	18.4
			3: 9	29.79	17.7	3:11	34.98	18.4
			3:30	29.35	17.6	3:33	35.36	18.4
			3:52	29.78	17.7	3:54	35.13	18.4
			4:13	29.48	17.8	4:16	34.51	18.4
			4:35	26.70	17.7	4:37	34.36	18.4
			4:56	28.10	17.8	5: 0	32.93	18.3
			5:18	29.53	17.7	5:20	31.31	18.3
			5:40	27.95	17.5	5:42	31.79	18.4
			6: 1	28.17	17.6	6: 3	31.62	18.3
			6:23	28.39	17.6	6:25	31.06	18.5
			6:44	28.24	17.5	6:47	30.03	18.3
			7: 6	26.91	17.5	7: 8	30.35	18.5
			7:27	28.72	17.5	7:30	29.88	18.3
			7:50	26.93	17.5	7:51	29.33	18.3
			8:10	27.52	17.6	8:13	29.67	18.4
			8:32	28.18	17.5	8:34	29.45	18.4
			8:53	26.28	17.5	8:56	29.39	18.3
			9:15	25.98	17.7	9:17	29.54	18.3
			9:36	25.82	17.5	9:39	28.68	18.3
			9:58	28.10	17.4	10: 1	28.68	18.4
			10:19	25.86	17.6			
			10:41	25.93	17.7			
			11: 3	24.43	17.8			
11:43	19.08	15.6	11:25	47.57	17.8			
12: 5	19.35	15.5	11:46	27.46	17.8			
12:26	19.57	15.6	12: 7	28.46	17.7			
12:48	20.39	15.6	12:29	28.12	17.8			
13: 9	21.01	15.6	12:50	29.04	17.8			
13:31	21.16	15.6	13:12	29.13	17.9			
13:52	22.08	15.8	13:33	29.46	17.9			
14:14	23.02	15.9	13:55	-16.51	18.2			
14:35	23.83	16.0	14:16	29.85	18.1			
14:57	24.88	16.2	14:38	29.93	18.1			
15:18	25.55	16.3	15: 0	29.61	18.3			
15:40	25.59	16.5	15:21	29.27	18.3			
16: 1	26.47	16.7	15:43	31.29	18.3			
16:23	27.15	16.7	16: 4	30.78	18.4			
16:44	27.35	16.7	16:26	31.71	18.4			
17: 6	27.67	17.1	16:47	30.94	18.3			
17:28	28.28	17.0	17: 9	31.73	18.4			
17:50	27.81	17.1	17:30	32.80	18.4			
18:11	28.21	17.0	17:52	32.87	18.4			
18:32	30.16	17.2	18:13	32.78	18.5			
18:54	30.21	17.3	18:35	34.60	18.6			
19:15	31.07	17.4	18:56	34.88	18.7			
19:37	31.44	17.4	19:18	35.70	18.7			
19:58	30.85	17.4	19:39	37.61	18.7			
20:20	30.65	17.3	20: 1	37.49	18.6			
20:41	31.73	17.4	20:22	37.86	18.6			
21: 3	30.86	17.5	20:44	37.72	18.6			
21:25	30.66	17.4	21: 5	37.86	18.6			
21:46	31.41	17.5	21:27	37.33	18.6			
22: 7	30.65	17.5	21:48	37.46	18.6			
22:29	30.83	17.5	22:10	36.83	18.6			
22:51	31.82	17.6	22:31	36.41	18.7			
23:12	31.03	17.4	22:53	37.61	18.7			
23:34	31.54	17.6	23:15	37.18	18.8			
23:55	31.95	17.7	23:36	36.53	18.8			

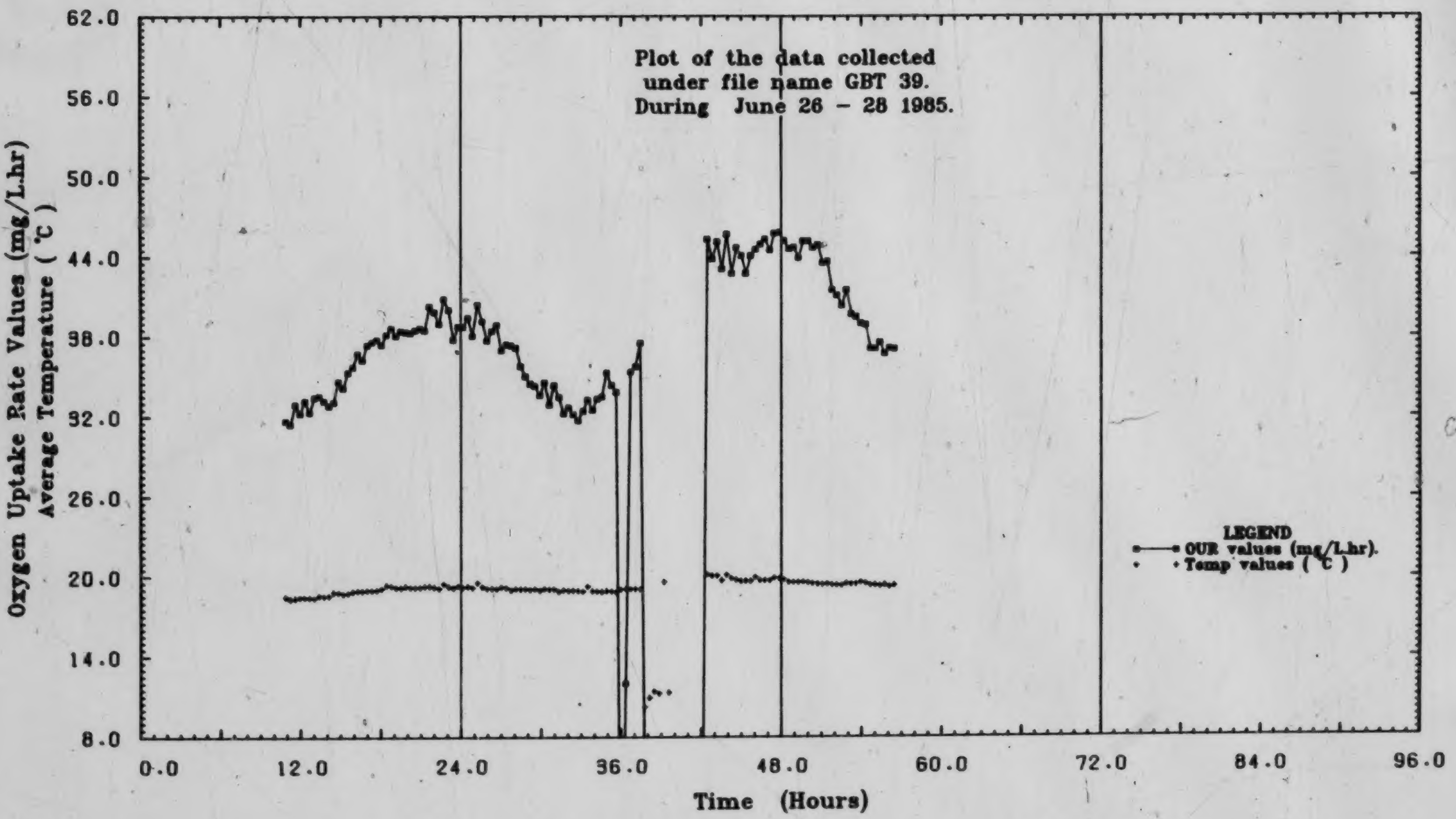
These data were collected under file GBT#388

The Results of The Automated Oxygen Uptake Rate Apparatus.

(For the period of 26-28 / 6 / 1988)

DAY 1 26 6 88			DAY 2 27 6 88			DAY 3 28 6 88		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 7	38.50	19.2	0:10	45.23	19.8
			0:29	38.46	19.3	0:32	44.83	19.7
			0:50	38.12	19.2	0:53	44.73	19.7
			1:12	40.44	19.5	1:15	43.94	19.7
			1:34	39.20	19.3	1:36	45.18	19.7
			1:55	37.78	19.2	1:58	45.20	19.6
			2:17	38.47	19.2	2:19	44.70	19.6
			2:38	38.81	19.1	2:41	44.91	19.5
			3: 0	37.05	19.3	3: 3	43.57	19.5
			3:21	37.48	19.2	3:25	43.68	19.5
			3:43	37.41	19.0	3:46	41.55	19.5
			4: 4	37.23	19.1	4: 7	41.13	19.4
			4:26	35.85	19.1	4:29	40.36	19.4
			4:47	36.10	19.1	4:50	41.52	19.6
			5: 9	34.53	19.1	5:12	39.72	19.5
			5:30	34.38	19.1	5:33	39.52	19.5
			5:52	33.88	19.0	5:55	39.03	19.6
			6:13	34.61	19.2	6:16	38.93	19.6
			6:35	32.96	19.1	6:38	37.18	19.4
			6:56	34.41	19.1	7: 0	37.15	19.4
			7:18	33.52	18.9	7:21	37.50	19.4
			7:39	32.31	19.1	7:42	36.79	19.4
			8: 1	32.74	19.0	8: 4	37.16	19.3
			8:22	32.24	19.0	8:25	37.13	19.4
			8:44	31.78	19.0			
			9: 5	32.48	19.0			
			9:27	33.32	19.3			
			9:50	32.50	19.0			
			10:10	33.41	19.0			
10:51	31.71	18.5	10:32	33.56	18.9			
11:12	31.46	18.4	10:53	35.35	19.0			
11:34	32.94	18.4	11:15	34.44	19.0			
11:55	32.27	18.5	11:36	33.61	18.9			
12:17	33.20	18.5	11:58	-12.88	19.1			
12:38	32.37	18.5	12:19	12.04	19.2			
13: 0	33.47	18.4	12:41	35.44	19.1			
13:22	31.57	18.6	13: 2	35.83	19.2			
13:43	33.22	18.6	13:25	37.58	19.1			
14: 5	32.86	18.6	13:46	3.25	10.3			
14:26	33.12	18.9	14: 7	2.76	11.0			
14:48	31.87	18.9	14:28	2.13	11.5			
15: 9	34.18	18.8	14:50	2.17	11.3			
15:31	35.35	18.8	15:11	-0.85	10.7			
15:52	35.78	18.9	15:33	1.95	11.4			
16:14	31.76	19.0	15:55	1.57	5.8			
16:35	31.29	19.0	16:16	1.40	4.7			
16:57	37.41	19.0	16:38	1.45	6.1			
17:18	37.64	19.0	17: 0	1.50	6.2			
17:40	37.82	19.0	17:21	0.72	6.5			
18: 1	37.44	19.1	17:42	0.53	6.4			
18:23	31.19	19.4	18: 4	1.63	6.0			
18:45	31.86	19.3	18:26	45.34	20.3			
19: 6	31.12	19.2	18:47	43.88	20.1			
19:28	31.46	19.2	19: 9	45.15	20.2			
19:50	31.39	19.3	19:30	43.13	19.8			
20:11	31.33	19.3	19:52	45.72	20.2			
20:32	31.53	19.2	20:14	42.80	20.0			
20:54	31.66	19.2	20:35	44.72	19.8			
21:15	38.53	19.3	20:57	44.12	19.7			
21:37	40.32	19.3	21:18	42.80	19.7			
21:58	39.90	19.2	21:40	44.11	19.7			
22:20	39.02	19.2	22: 1	44.58	20.0			
22:41	40.87	19.5	22:23	44.97	19.8			
23: 3	40.06	19.3	22:44	45.35	19.8			
23:25	37.83	19.2	23: 6	44.52	19.8			
23:46	38.80	19.3	23:27	45.79	20.0			

These data were collected under file GBT#39



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of June 28 to July 1 1985)

DAY 1 28 6 85			DAY 2 29 6 85			DAY 3 30 6 85			DAY 4 1 7 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:14	50.24	20.5	0:17	41.72	19.6	0: 0	38.52	19.8
			0:36	48.48	20.2	0:39	41.39	19.7	0:20	38.45	19.7
			0:57	50.13	20.3	1: 0	43.54	19.6	0:42	37.25	19.5
			1:19	51.88	20.3	1:22	33.82	19.5	1: 3	37.16	19.4
			1:40	51.96	20.3	1:43	40.88	19.6	1:25	37.21	19.7
			2: 2	52.88	20.5	2: 5	39.15	19.6	1:46	38.50	19.4
			2:25	47.88	20.2	2:26	40.10	19.4	2: 8	35.62	19.4
			2:46	47.60	20.5	2:48	40.05	19.6	2:29	36.71	19.4
			3: 7	48.25	20.3	3: 9	40.21	19.5	2:51	37.07	19.4
			3:28	45.96	20.3	3:31	40.45	19.6	3:12	36.31	19.5
			3:50	46.78	20.2	3:52	38.59	19.6	3:34	35.82	19.4
			4:11	44.37	20.0	4:14	38.08	19.6	3:56	35.71	19.4
			4:33	44.00	20.1	4:36	38.09	19.5	4:17	35.38	19.4
			4:54	43.78	20.0	4:57	37.53	19.4	4:39	35.34	19.4
			5:16	44.53	19.9	5:19	0.0	19.3	5: 0	34.95	19.4
			5:37	45.02	19.9	5:40	37.82	19.4	5:22	35.04	19.4
			6: 0	43.47	19.7	6: 2	37.25	19.4	5:43	35.16	19.3
			6:20	41.93	19.8	6:23	38.68	19.3	6: 5	34.40	19.4
			6:42	41.23	19.7	6:45	36.38	19.4	6:26	34.33	19.3
			7: 3	41.76	19.6	7: 6	35.26	19.6	6:48	32.86	19.4
			7:25	40.57	19.8	7:28	35.38	19.4	7: 9	33.89	19.3
			7:46	39.28	19.7	7:50	0.0	19.5	7:31	33.04	19.3
			8: 8	39.70	19.7	8:11	35.53	19.4	7:52	32.08	19.4
			8:29	39.40	19.8	8:33	36.07	19.3	8:14	33.17	19.3
			8:51	38.75	19.7	8:54	35.68	19.4	8:35	33.06	19.4
			9:12	37.27	19.8	9:16	34.29	19.3	8:57	32.46	19.4
9:32	38.94	19.5	9:34	38.14	19.7	9:37	34.61	19.4	9:18	32.42	19.4
9:54	38.67	19.3	9:56	38.38	19.8	10: 0	34.28	19.4	9:40	31.73	19.4
10:15	41.58	19.3	10:17	39.06	19.8	10:20	31.74	19.4	10: 1	31.95	19.4
10:37	40.61	19.3	10:39	38.97	19.7	10:42	29.37	19.5	10:23	32.32	19.4
10:58	42.00	19.4	11: 0	40.12	19.8	11: 3	33.34	19.4	10:44	33.52	19.5
11:20	42.60	19.3	11:22	40.10	19.8	11:25	33.50	19.3	11: 6	32.93	19.5
11:41	43.88	19.4	11:43	39.41	19.7	11:46	35.16	19.4	11:27	31.16	19.4
12: 3	43.40	19.4	12: 5	41.02	19.8	12: 8	34.33	19.4	11:50	31.86	19.3
12:25	43.30	19.4	12:26	40.97	19.8	12:29	35.68	19.6	12:10	32.18	19.5
12:46	44.30	19.4	12:48	39.93	19.8	12:51	35.70	19.6	12:32	33.16	19.5
13: 7	45.79	19.5	13: 9	40.62	19.8	13:13	33.85	19.4	12:53	32.37	19.6
13:29	46.90	19.5	13:31	41.57	19.8	13:34	0.0	19.5	13:15	34.23	19.7
13:50	44.98	19.6	13:52	40.72	19.8	13:56	29.10	19.3	13:37	33.91	19.6
14:12	45.00	19.7	14:14	42.06	19.8	14:17	33.19	19.3	13:58	36.55	19.5
14:33	44.03	19.7	14:35	39.52	19.8	14:39	37.13	19.5	14:20	37.10	19.6
14:55	47.59	19.8	14:57	42.17	19.8	15: 1	38.98	19.5	14:41	35.86	19.7
15:16	52.54	20.1	15:18	42.84	19.9	15:22	38.56	19.4	15: 3	36.52	19.7
15:38	48.88	19.9	15:40	43.56	19.7	15:44	36.29	19.4	15:25	35.04	19.8
16: 0	46.74	20.0	16: 2	42.99	19.7	16: 5	38.01	19.4	15:46	37.18	19.7
16:21	48.30	20.0	16:23	43.92	19.7	16:27	38.48	19.5	16: 7	37.23	19.7
16:42	51.84	20.1	16:45	43.26	19.7	16:48	38.61	19.5	16:29	37.68	19.7
17: 4	50.73	20.2	17: 6	42.10	19.9	17:10	-18.22	19.5	16:50	38.74	19.8
17:26	52.78	20.2	17:28	42.84	19.7	17:31	38.91	19.7	17:12	38.16	19.7
17:47	53.71	20.5	17:50	41.81	19.7	17:53	39.07	19.6	17:33	37.37	19.8
18: 9	48.94	20.3	18:11	42.22	19.6	18:14	38.58	19.7	17:55	36.17	19.7
18:30	48.75	20.3	18:32	42.55	19.7	18:36	38.45	19.6	18:16	37.59	19.8
18:52	52.16	20.3	18:54	42.67	19.8	18:57	37.28	19.7	18:38	38.08	20.0
19:13	54.23	20.3	19:15	43.89	19.8	19:19	0.0	19.6	19: 0	38.40	19.7
19:35	54.22	20.4	19:37	44.50	19.7	19:40	37.83	19.6	19:21	38.84	19.8
19:56	54.24	20.3	19:58	45.30	19.7	20: 2	38.88	19.7	19:42	39.64	19.8
20:18	51.48	20.2	20:20	44.15	19.7	20:23	38.40	19.5	20: 4	40.23	20.0
20:39	53.72	20.4	20:42	43.78	19.7	20:45	38.14	19.9	20:25	38.70	19.9
21: 1	51.17	20.3	21: 3	43.02	19.8	21: 6	37.68	19.7	20:47	40.33	20.0
21:22	53.27	20.3	21:25	41.89	19.7	21:28	38.55	19.8	21: 8	39.61	20.0
21:44	52.66	20.5	21:46	42.88	19.7	21:50	38.81	19.8	21:30	39.48	20.1
22: 5	52.68	20.5	22: 8	42.68	19.7	22:11	37.04	19.8	21:52	38.45	19.9
22:27	50.94	20.4	22:29	38.65	19.8	22:33	36.82	19.5	22:13	39.27	19.8
22:48	51.13	20.4	22:51	41.46	19.9	22:54	0.0	19.5	22:35	39.05	20.0
23:10	50.54	20.3	23:12	39.35	19.7	23:16	35.23	19.5	22:58	40.14	20.0
23:31	50.57	20.4	23:34	40.92	19.5	23:37	36.75	19.9	23:16	40.48	19.9
23:53	50.64	20.4	23:55	40.79	19.8	0: 0	38.52	19.8	23:39	38.31	19.9

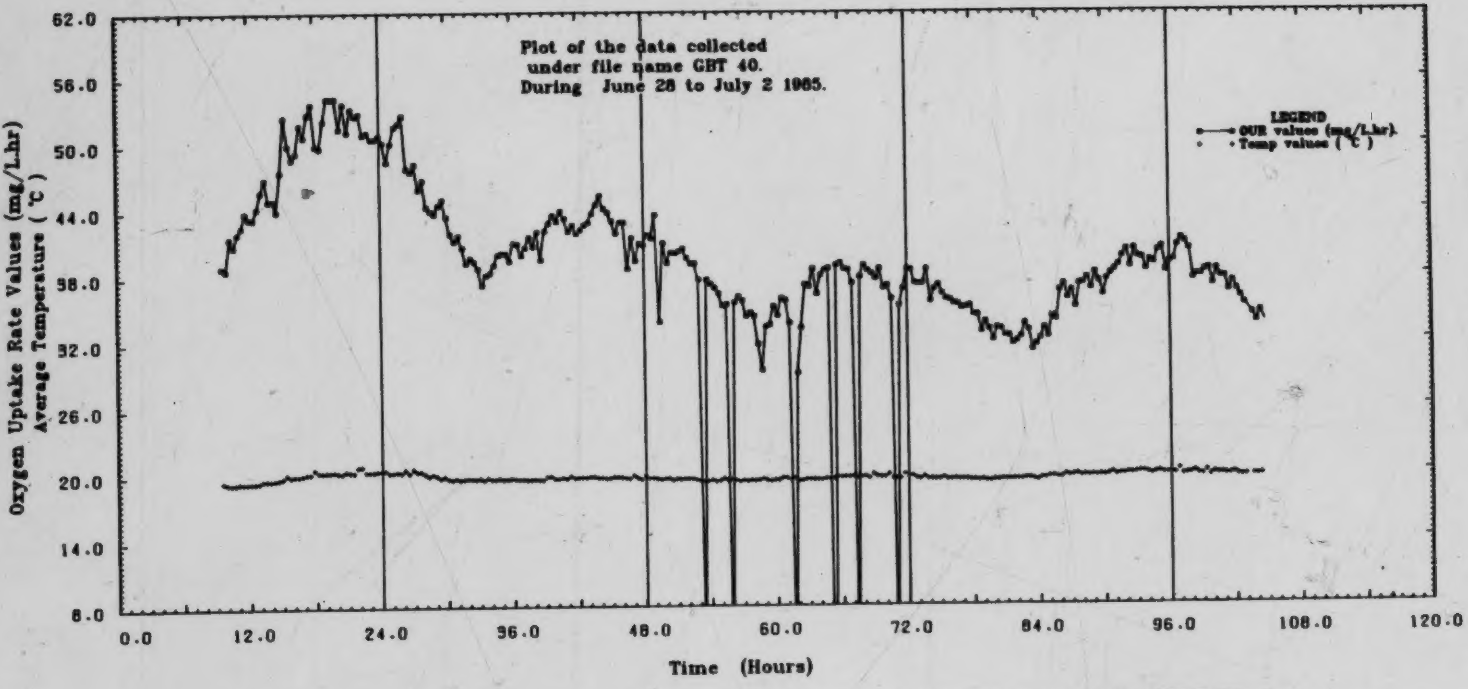
These data were collected under file SBT#40

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 2 / 7 / 1986)

DAY 5 2 7 86		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0: 1	39.08	20.0
0:22	39.27	19.8
0:44	40.52	20.2
1: 6	41.24	19.8
1:28	40.81	19.8
1:49	40.29	19.9
2:10	37.61	20.0
2:31	37.94	19.8
2:53	37.86	19.7
3:14	38.36	20.1
3:36	38.49	19.7
3:57	37.09	19.9
4:19	38.43	19.8
4:41	37.78	19.8
5: 2	37.73	19.7
5:24	38.52	19.8
5:45	37.30	19.9
6: 7	36.55	19.7
6:28	35.84	19.8
6:50	35.30	19.7
7:33	34.36	19.7
7:55	33.86	19.7
8:16	34.56	19.7

These data were collected under file GBT#40

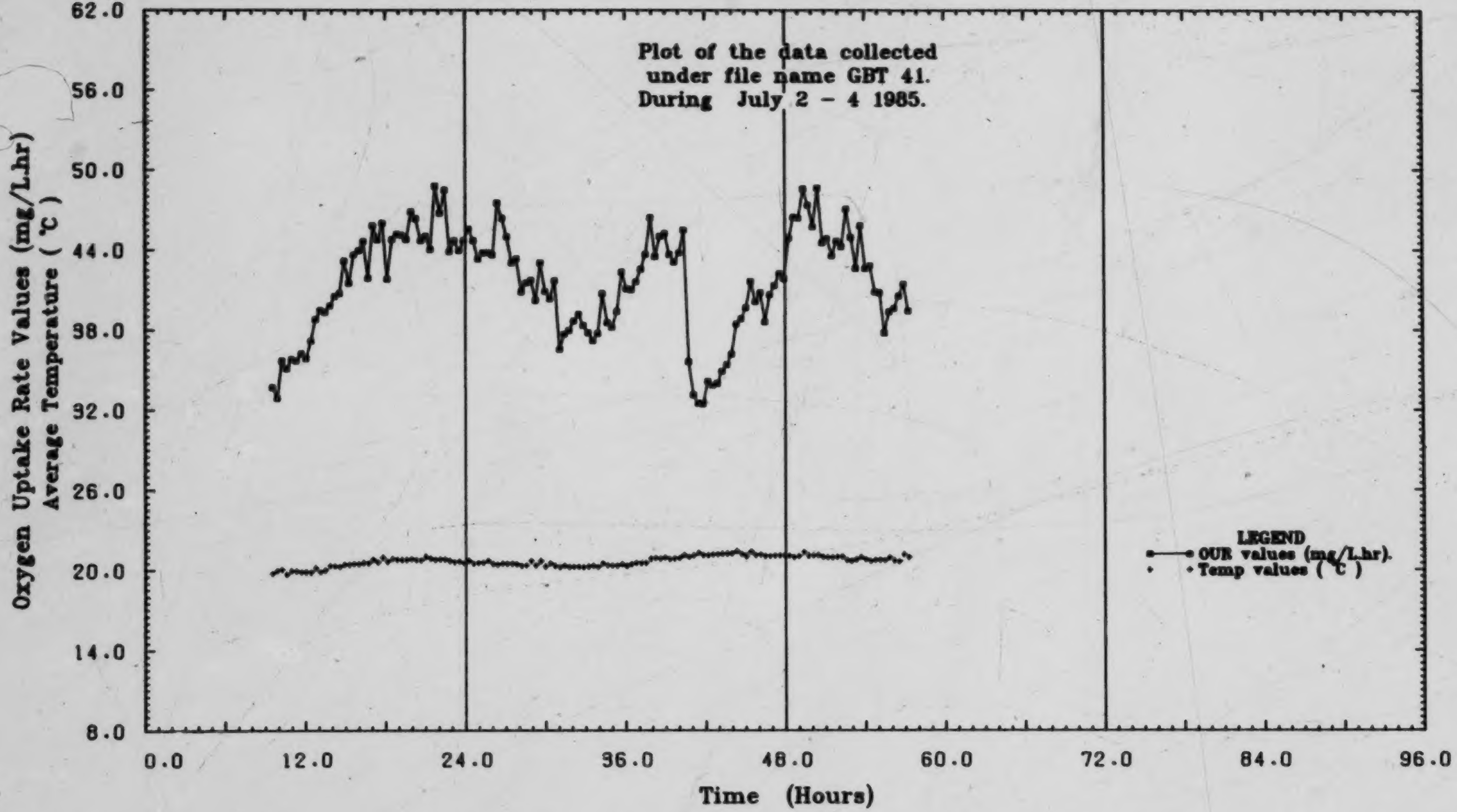


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 2- 4 / 7 / 1985)

DAY 1 2 7 85			DAY 2 3 7 85			DAY 3 4 7 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:13	45.51	20.7	0:15	44.84	21.1
			0:34	44.64	20.5	0:36	46.42	21.0
			0:55	43.30	20.6	0:58	46.38	21.0
			1:17	43.73	20.6	1:20	46.54	21.3
			1:38	43.75	20.7	1:41	47.32	21.1
			2: 1	43.56	20.5	2: 3	45.71	21.1
			2:22	47.47	20.4	2:25	46.80	21.1
			2:44	45.33	20.5	2:46	44.50	21.0
			3: 5	44.93	20.5	3: 7	44.60	21.0
			3:27	42.96	20.5	3:29	43.52	20.9
			3:48	43.28	20.5	3:50	44.63	21.0
			4:10	40.80	20.4	4:12	44.21	21.0
			4:31	41.47	20.4	4:34	47.03	20.8
			4:53	41.68	20.7	4:55	44.90	20.7
			5:14	40.17	20.4	5:17	42.58	20.8
			5:36	42.98	20.7	5:38	45.77	21.0
			5:57	40.63	20.3	6: 0	42.59	20.8
			6:19	40.28	20.5	6:21	42.77	20.7
			6:40	41.64	20.3	6:43	40.81	20.8
			7: 2	38.51	20.2	7: 4	40.73	20.8
			7:23	37.63	20.4	7:26	37.72	20.7
			7:45	37.91	20.2	7:47	39.28	20.9
			8: 6	38.82	20.3	8: 9	39.58	20.7
			8:28	39.11	20.3	8:31	40.50	20.8
			8:50	38.30	20.2	8:52	41.39	21.2
			9:11	37.76	20.3	9:14	38.38	21.0
9:30	33.70	19.8	9:32	37.16	20.4			
9:52	32.80	20.0	9:54	37.86	20.3			
10:13	35.70	20.1	10:15	40.67	20.5			
10:35	35.12	19.7	10:37	38.60	20.4			
10:56	35.81	20.0	10:58	38.16	20.4			
11:18	35.71	20.0	11:20	39.33	20.3			
11:40	36.24	19.9	11:42	42.26	20.5			
12: 1	35.86	19.9	12: 3	41.03	20.3			
12:23	37.18	19.9	12:25	40.87	20.5			
12:44	38.78	20.2	12:46	41.55	20.6			
13: 6	39.44	19.9	13: 8	42.51	20.5			
13:27	39.31	20.0	13:29	43.62	20.6			
13:50	39.79	20.4	13:51	46.38	20.9			
14:10	40.49	20.3	14:12	43.46	20.9			
14:32	40.72	20.3	14:34	44.87	20.9			
14:53	43.15	20.5	14:55	46.16	21.0			
15:15	41.46	20.5	15:17	43.61	20.8			
15:36	43.60	20.5	15:38	43.04	20.9			
15:58	43.91	20.5	16: 0	43.73	20.9			
16:19	44.58	20.6	16:21	45.43	21.1			
16:41	41.86	20.5	16:43	35.56	21.0			
17: 2	45.77	20.6	17: 4	33.06	21.1			
17:25	44.72	20.6	17:26	32.46	21.3			
17:46	45.95	21.0	17:47	32.42	21.1			
18: 7	41.79	20.7	18: 9	34.09	21.1			
18:29	44.74	20.9	18:30	33.61	21.2			
18:50	45.14	20.8	18:52	33.94	21.2			
19:12	45.07	20.8	19:13	34.85	21.2			
19:33	44.75	20.8	19:35	35.38	21.2			
19:55	46.81	20.9	19:56	36.15	21.2			
20:16	46.30	20.8	20:18	38.40	21.4			
20:38	44.66	20.6	20:40	38.79	21.2			
21: 0	44.97	21.0	21: 1	39.82	21.0			
21:21	44.00	20.9	21:23	41.56	21.4			
21:42	45.73	20.8	21:44	40.06	21.1			
22: 4	46.72	20.9	22: 6	40.74	21.2			
22:25	45.44	20.9	22:27	38.57	21.0			
22:47	43.85	20.7	22:50	40.59	21.1			
23: 8	44.66	20.6	23:10	41.26	21.1			
23:30	43.91	20.7	23:32	42.19	21.1			
23:51	44.63	20.6	23:53	41.81	21.1			

These data were collected under file SBT#41



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 4- 7 / 7 / 1985)

DAY 1 4 7 85			DAY 2 5 7 85			DAY 3 6 7 85			DAY 4 7 7 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 3	50.15	21.8	0: 6	53.11	22.1	0: 8	43.20	21.7
			0:25	47.00	21.9	0:27	52.22	22.2	0:29	0.0	21.6
			0:46	53.11	21.9	0:50	53.11	22.2	0:51	0.0	21.6
			1: 8	50.43	21.7	1:10	48.74	22.0	1:12	0.0	21.5
			1:29	49.18	21.7	1:31	46.28	21.9	1:34	43.03	21.6
			1:51	50.80	21.7	1:53	46.60	21.8	1:55	43.20	21.6
			2:12	50.93	21.5	2:14	53.11	21.8	2:17	38.83	21.6
			2:34	50.43	21.7	2:36	53.11	21.8	2:38	38.06	21.3
			2:55	50.75	21.8	2:57	53.23	21.9	3: 0	0.0	21.3
			3:17	53.05	21.5	3:19	53.23	21.8	3:21	0.0	21.1
			3:38	50.28	21.7	3:41	45.89	21.8	3:43	0.0	21.3
			4: 0	47.82	21.8	4: 2	52.30	21.8	4: 4	0.0	20.9
			4:22	48.35	21.7	4:25	43.59	21.9	4:26	0.0	20.9
			4:43	44.29	21.5	4:45	51.05	21.7	4:48	0.0	21.1
			5: 5	0.99	8.4	5: 7	49.59	21.7	5: 9	0.0	21.0
			5:26	47.10	21.6	5:28	46.76	21.6	5:31	0.0	21.0
			5:48	44.47	21.4	5:50	44.51	21.6	5:52	0.0	21.1
			6: 9	44.70	21.3	6:11	44.64	21.6	6:14	0.0	21.1
			6:31	44.63	21.4	6:33	40.51	21.6	6:35	0.0	21.0
			6:52	43.02	21.4	6:54	45.00	21.5	6:57	0.0	21.0
			7:14	42.79	21.3	7:16	43.34	21.5	7:18	0.0	21.0
			7:35	44.81	21.4	7:37	48.49	21.7	7:40	0.0	21.0
			7:57	44.37	21.7	8:21	40.33	21.8	8: 1	0.0	21.0
			8:18	43.02	21.4	8:42	42.00	21.8	8:23	0.0	21.0
			8:40	43.75	21.5	9: 4	41.26	21.8	8:44	0.0	21.0
			9: 1	43.02	21.4	9:25	44.03	21.7	9: 6	0.0	21.0
			9:23	43.02	21.3	9:47	41.38	21.7	9:27	0.0	21.0
			9:45	43.02	21.2	10: 8	40.54	21.6	9:50	0.0	20.9
			10: 6	42.94	21.4	10:30	38.39	21.5	10:10	0.0	20.9
10: 4	39.77	20.8	10:28	42.88	21.4	10:51	37.07	21.5	10:32	0.0	20.9
10:25	39.08	20.9	10:50	44.84	21.4	11:13	41.16	21.6	10:53	0.0	20.9
10:47	42.10	21.0	11:11	46.38	21.3	11:34	40.17	21.6	11:15	0.0	21.1
11: 8	40.67	21.0	11:32	41.88	21.2	11:56	42.29	21.7	11:37	0.0	21.0
11:30	41.75	21.0	11:54	43.84	21.7	12:17	41.05	21.6	11:58	0.0	20.9
11:51	41.89	20.9	12:15	45.19	21.4	12:39	39.83	21.6	12:20	0.0	20.8
12:13	43.28	21.0	12:37	48.23	21.4	13: 0	40.87	21.8	12:41	0.0	20.8
12:34	45.39	21.1	12:58	53.23	21.5	13:22	45.08	21.7	13: 3	0.0	20.8
12:56	42.82	21.1	13:20	57.61	21.5	13:44	40.36	21.7	13:25	0.0	20.8
13:17	46.71	21.1	13:41	50.01	21.5	14: 5	39.78	21.7	13:46	0.0	21.0
13:39	44.81	21.2	14: 3	0.0	21.5	14:27	42.91	21.9	14: 7	0.0	21.5
14: 0	44.13	21.2	14:25	0.0	21.7	14:48	45.83	21.8	14:29	0.0	21.2
14:22	41.84	21.3	14:46	0.0	21.8	15:10	43.22	21.8	14:50	0.0	21.2
14:43	47.08	21.7	15: 8	0.0	21.9	15:31	42.85	21.6	15:12	0.0	21.2
15: 5	43.31	21.4	15:29	52.08	21.9	15:53	43.34	22.0	15:33	0.0	21.3
15:26	45.66	21.6	15:51	48.23	21.8	16:14	42.65	21.6	15:55	0.0	21.3
15:48	48.45	21.7	16:12	53.26	21.8	16:36	43.34	21.9	16:16	0.0	21.2
16:10	46.56	21.4	16:34	45.42	22.2	16:57	41.18	21.9	17: 0	0.0	21.4
16:31	47.73	21.6	16:55	45.01	22.0	17:19	40.84	22.0	17:21	0.0	21.2
16:53	50.82	21.9	17:17	45.01	22.1	17:40	45.11	22.0	17:43	0.0	21.1
17:14	47.37	21.6	17:38	45.01	22.0	18: 2	39.21	22.0	18: 4	0.0	21.3
17:36	47.22	21.8	18: 0	55.51	22.2	18:23	41.60	22.0	18:26	0.0	21.5
17:57	46.83	21.7	18:21	0.0	22.2	18:45	47.84	22.0	18:47	0.0	21.2
18:19	50.43	21.9	18:43	45.01	22.2	19: 6	42.74	22.0	19: 9	0.0	21.2
18:40	50.20	21.9	19: 4	45.01	22.2	19:28	42.81	22.1	19:30	0.0	21.2
19: 2	50.38	21.9	19:26	45.01	22.2	19:50	43.22	22.0	19:52	0.0	21.3
19:23	50.93	21.9	19:47	50.01	22.3	20:11	44.41	22.0	20:14	0.0	21.3
19:45	47.27	22.1	20: 9	50.01	22.5	20:32	47.00	22.0	20:35	0.0	21.2
20: 6	48.49	22.1	20:31	53.11	22.2	20:54	43.34	22.0	20:57	0.0	21.4
20:28	48.57	22.0	20:52	52.03	22.3	21:15	42.85	22.1	21:18	0.0	21.2
20:50	47.00	22.0	21:14	45.85	22.3	21:37	36.08	22.0	21:40	0.0	21.2
21:11	48.41	22.1	21:35	53.11	22.5	22: 0	64.70	21.8	22: 1	0.0	21.3
21:32	51.18	21.9	21:57	52.06	22.6	22:20	39.82	21.7	22:23	0.0	21.2
21:54	53.11	22.3	22:18	51.19	22.3	22:42	38.83	21.9	22:44	0.0	21.4
22:16	50.87	21.7	22:39	48.88	22.2	23: 3	45.01	22.0	23: 6	0.0	21.0
22:37	47.27	21.7	23: 1	51.19	22.3	23:25	0.0	21.9	23:27	0.0	21.3
23: 0	47.11	21.8	23:22	53.11	22.3	23:46	39.84	21.6	23:50	0.0	21.1
23:20	50.43	22.0	23:44	45.88	22.2	0: 8	43.20	21.7	0:11	0.0	21.0
23:42	50.93	21.7	0: 5	53.11	22.1	0:29	0.0	21.8	0:32	0.0	21.0

These data were collected under file GBT#42

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 8 / 7 / 1985)

DAY 5 8 7 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0:11	0.0	21.0
0:32	0.0	21.0
0:54	0.0	20.9
1:15	0.0	20.9
1:58	0.0	20.8
2:20	0.0	20.8
2:41	0.0	21.0
3: 3	0.0	21.2
3:25	0.0	20.9
3:46	0.0	20.8
4: 8	0.0	20.8
4:29	0.0	21.1
4:51	0.0	21.0
5:55	0.0	20.8
6:17	0.0	20.7
6:38	0.0	20.8
7: 0	0.0	20.9
7:22	0.0	20.8
7:43	0.0	20.7
8: 5	0.0	20.7
8:26	0.0	20.7
8:48	0.0	20.8
9:10	0.0	20.7
9:31	0.0	20.8
9:53	0.0	20.8
10:14	0.0	21.0
10:36	0.0	20.7
10:57	0.0	20.9
11:19	0.0	20.9
11:40	0.0	21.0
12: 2	0.0	21.3
12:23	0.0	21.0
12:45	0.0	21.0
13: 7	0.0	21.1
13:28	0.0	21.0
13:50	0.0	21.1
14:11	0.0	21.4
14:54	0.0	21.1
15:16	0.0	21.3
15:37	0.0	21.4

These data were collected under file GBT#42

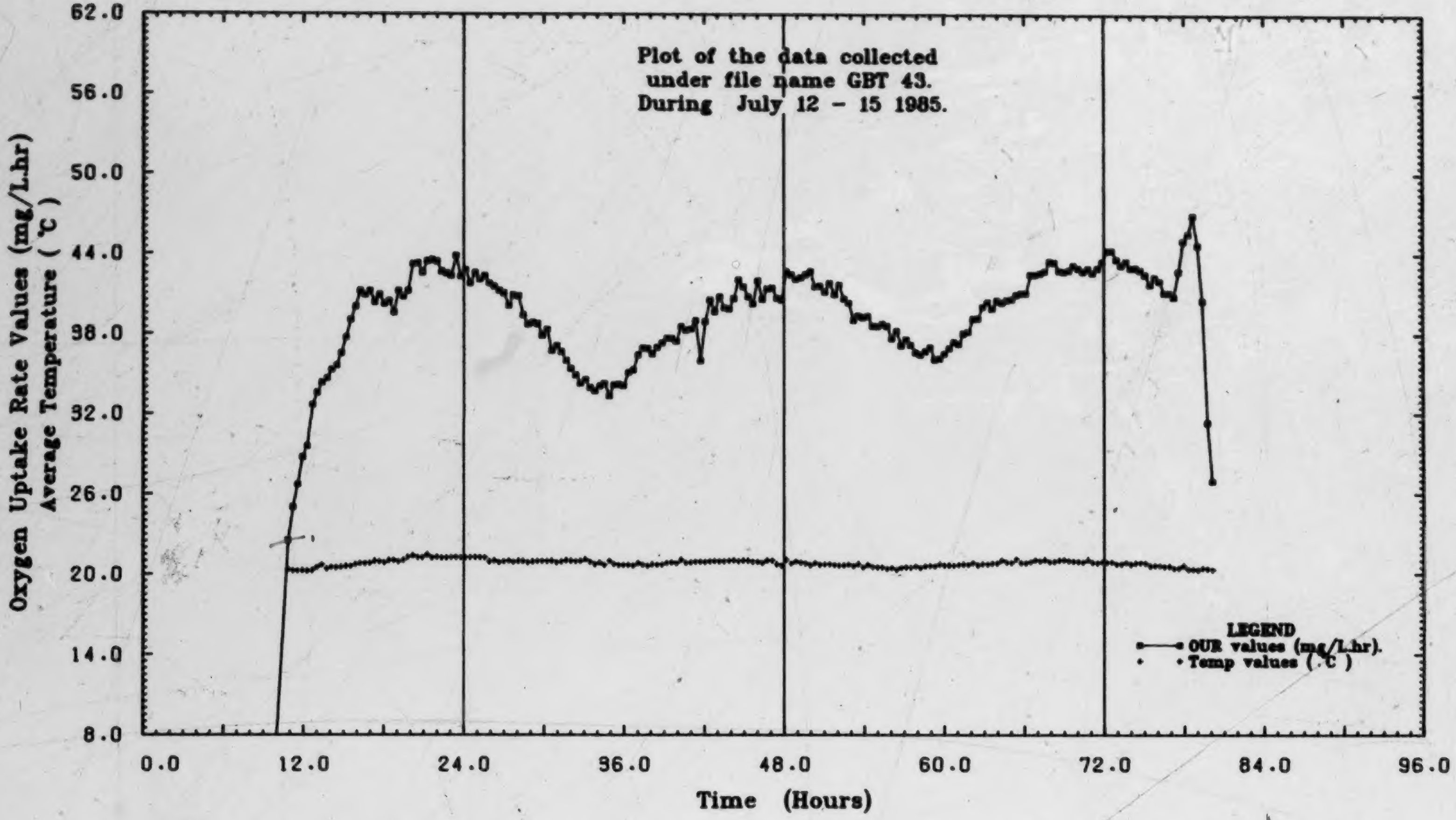
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 12-15 / 7 / 1985)

DAY 1			DAY 2			DAY 3			DAY 4		
12 7 85			13 7 85			14 7 85			15 7 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 7	42.77	21.3	0: 9	42.70	21.1	0:12	44.28	20.9
			0:28	41.76	21.3	0:31	42.44	20.8	0:33	44.31	21.0
			0:50	42.57	21.3	0:52	42.11	21.0	0:55	43.84	20.8
			1:11	42.05	21.3	1:14	42.24	20.9	1:16	43.22	20.8
			1:33	42.33	21.3	1:35	42.47	20.8	1:38	43.48	20.9
			1:54	41.77	21.0	1:57	42.72	20.7	2: 0	42.88	20.8
			2:16	41.53	21.1	2:18	41.58	20.9	2:21	43.01	20.9
			2:38	41.22	20.9	2:40	41.80	20.7	2:42	42.84	20.9
			3: 0	41.00	21.0	3: 2	41.14	20.8	3: 4	42.51	20.9
			3:21	40.10	21.0	3:23	41.81	20.8	3:26	41.74	20.7
			3:42	40.87	21.0	3:45	40.86	20.7	3:47	42.31	20.7
			4: 4	40.80	21.0	4: 6	41.85	20.7	4: 9	42.01	20.7
			4:25	39.39	21.0	4:28	40.64	20.7	4:30	41.12	20.6
			4:47	38.70	20.9	4:50	40.22	20.7	4:52	41.12	20.6
			5: 8	38.84	21.0	5:11	39.05	20.6	5:13	40.81	20.5
			5:30	38.72	21.0	5:32	39.35	20.8	5:35	42.76	20.5
			5:51	37.88	21.0	5:54	39.24	20.5	5:56	45.01	20.7
			6:13	38.29	21.0	6:15	38.34	20.7	6:18	45.56	20.4
			6:34	36.72	21.0	6:37	38.61	20.6	6:39	46.92	20.4
			6:56	37.08	20.9	7: 0	38.58	20.5	7: 1	44.70	20.4
			7:17	36.65	21.0	7:20	38.75	20.5	7:22	40.52	20.5
			7:38	35.99	21.1	7:42	38.55	20.4	7:44	31.36	20.4
			8: 0	35.38	21.0	8: 3	37.87	20.5	8: 5	26.87	20.4
			8:22	34.89	21.0	8:25	36.22	20.4			
			8:43	34.27	21.0	8:46	37.14	20.5			
			9: 5	34.54	21.1	9: 8	37.59	20.6			
9:31	-0.27	0.2	9:26	33.85	21.0	9:29	37.19	20.6			
10:50	22.55	20.4	9:48	33.71	20.8	9:51	36.62	20.6			
11:12	25.05	20.3	10:10	34.07	20.9	10:12	36.46	20.5			
11:33	26.78	20.3	10:31	34.25	20.7	10:34	36.72	20.5			
11:55	28.79	20.3	10:53	33.35	21.0	10:56	37.00	20.7			
12:16	29.61	20.3	11:14	34.16	20.8	11:17	38.10	20.5			
12:38	32.89	20.3	11:36	34.18	20.7	11:39	38.17	20.6			
13: 0	33.59	20.5	11:57	34.09	20.7	12: 0	38.64	20.7			
13:21	34.34	20.7	12:19	35.08	20.7	12:22	36.95	20.7			
13:43	34.67	20.4	12:40	35.28	20.7	12:43	37.42	20.7			
14: 4	35.32	20.6	13: 2	36.40	20.9	13: 5	37.28	20.7			
14:26	35.62	20.5	13:23	36.90	20.7	13:26	38.05	20.8			
14:47	36.54	20.6	13:45	36.87	20.8	13:48	38.19	20.6			
15: 9	37.74	20.6	14: 6	36.48	20.8	14: 9	39.18	20.9			
15:30	38.05	20.6	14:28	36.97	20.7	14:31	39.20	20.7			
15:52	40.02	20.8	14:50	37.30	20.7	14:52	40.05	20.8			
16:13	41.20	20.9	15:11	37.67	20.9	15:14	40.40	20.8			
16:35	40.81	20.8	15:32	37.68	20.9	15:35	39.91	20.9			
16:56	41.20	20.9	15:54	37.43	20.9	15:57	40.52	20.9			
17:18	40.36	21.0	16:15	38.53	21.1	16:18	40.37	21.1			
17:39	40.81	21.0	16:37	38.28	20.9	16:40	40.57	20.8			
18: 1	40.24	20.9	17: 0	38.35	20.9	17: 2	40.62	20.9			
18:22	40.44	21.1	17:20	38.88	21.0	17:23	40.95	21.2			
18:44	39.59	21.1	17:42	35.97	21.0	17:45	41.08	20.9			
19: 5	41.20	21.0	18: 3	38.90	20.9	18: 6	41.08	20.9			
19:27	40.78	21.1	18:25	40.52	21.0	18:28	42.60	21.0			
19:48	41.20	21.3	18:46	39.65	21.0	18:50	42.50	21.1			
20:10	43.23	21.4	19: 8	40.77	21.0	19:11	42.61	21.0			
20:32	43.28	21.3	19:29	39.95	21.0	19:32	42.75	21.1			
20:53	42.56	21.3	19:51	39.86	21.0	19:54	43.48	21.0			
21:15	43.42	21.5	20:12	40.63	21.1	20:15	43.41	21.0			
21:36	43.62	21.3	20:34	42.05	21.0	20:37	42.79	21.1			
21:58	43.41	21.3	20:55	41.52	21.0	20:58	42.74	21.1			
22:19	42.86	21.3	21:17	40.78	21.0	21:20	42.82	21.0			
22:41	42.53	21.3	21:38	40.25	20.9	21:41	43.20	21.0			
23: 2	42.35	21.3	22: 0	41.98	21.0	22: 3	42.89	21.0			
23:25	43.81	21.3	22:21	40.59	20.9	22:25	42.74	20.9			
23:46	42.31	21.3	22:43	41.37	21.1	22:46	42.87	21.1			

These data were collected under file SBT#43



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

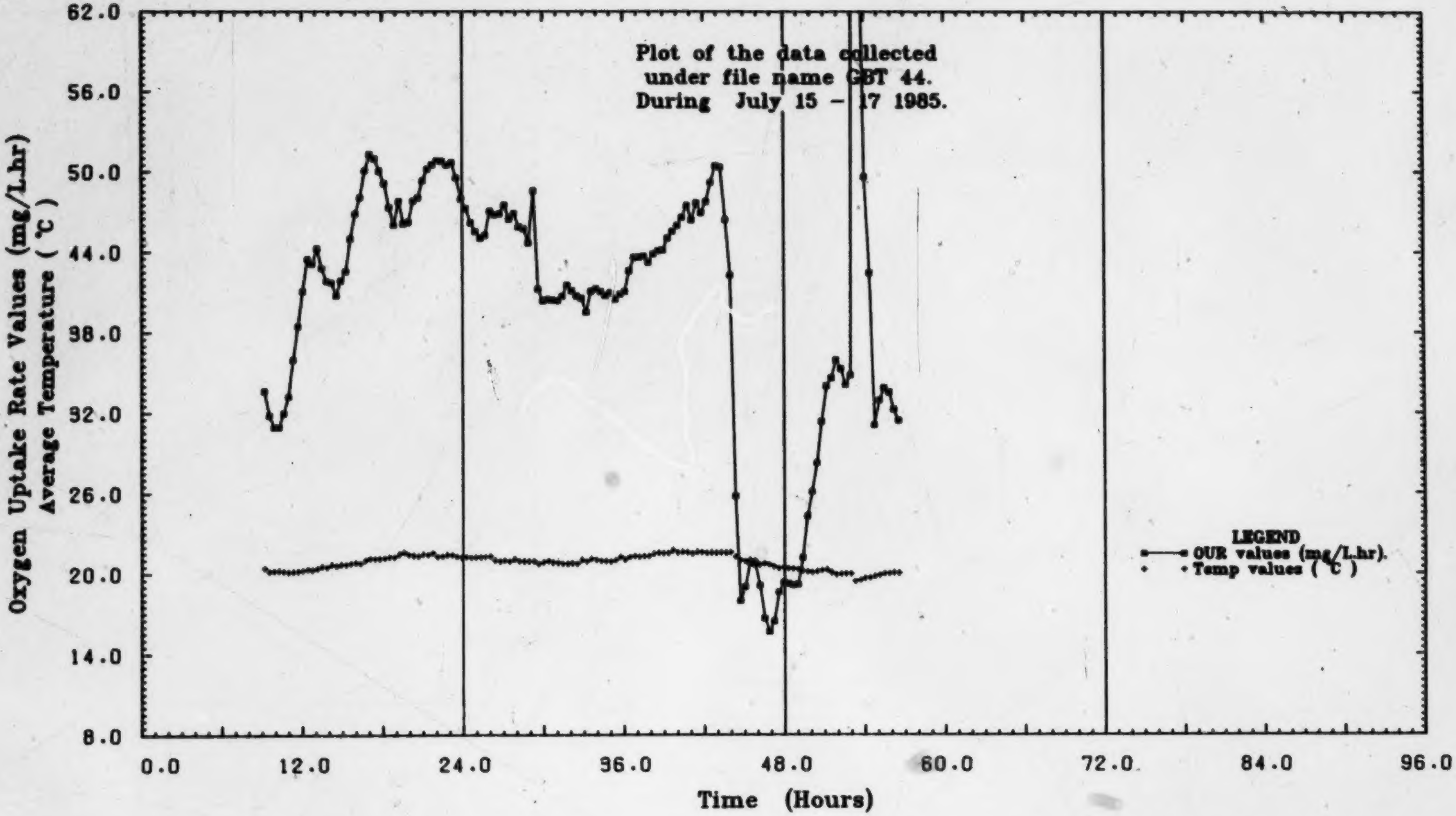
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 15-17 / 7 / 1985)

DAY 1 15 7 85			DAY 2 16 7 85			DAY 3 17 7 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:13	47.24	21.3	0:16	19.25	20.4
			0:35	46.18	21.3	0:37	19.15	20.4
			0:56	45.52	21.3	1: 0	19.19	20.3
			1:18	45.03	21.3	1:20	21.20	20.2
			1:39	46.24	21.3	1:42	24.29	20.2
			2: 1	47.04	21.3	2: 3	26.11	20.1
			2:22	46.78	21.0	2:25	28.27	20.2
			2:44	46.84	21.0	2:46	31.34	20.3
			3: 5	47.48	21.0	3: 8	33.88	20.3
			3:27	48.46	21.0	3:30	34.58	20.1
			3:50	48.65	21.1	3:51	35.92	19.9
			4:10	45.88	21.0	4:13	35.27	20.0
			4:32	45.73	21.0	4:34	34.09	20.0
			4:53	44.88	21.0	4:56	34.78	20.0
			5:15	46.55	21.0	5:17	107.89	19.4
			5:36	41.22	20.6	5:39	70.45	19.5
			5:58	40.34	20.9	6: 0	48.61	19.7
			6:20	40.45	21.0	6:22	42.44	19.7
			6:41	40.40	20.9	6:43	31.10	19.8
			7: 3	40.36	20.9	7: 5	32.94	19.9
			7:25	40.59	20.8	7:26	33.64	20.0
			7:46	41.51	20.8	7:48	33.52	20.0
			8: 7	41.10	20.8	8: 9	32.25	20.1
			8:28	40.71	20.8	8:31	31.43	20.1
			8:50	40.53	21.1			
			9:12	39.51	21.0			
9: 9	33.65	20.5	9:33	41.05	21.2			
9:31	31.63	20.2	9:55	41.24	21.1			
9:52	30.57	20.2	10:17	41.03	21.0			
10:14	30.56	20.3	10:38	40.73	21.0			
10:35	31.99	20.2	11: 0	40.94	21.0			
10:57	33.24	20.2	11:21	40.45	21.0			
11:18	35.99	20.2	11:43	40.64	21.3			
11:40	38.49	20.2	12: 4	41.04	21.1			
12: 1	41.08	20.3	12:25	42.57	21.3			
12:23	43.46	20.4	12:47	43.58	21.4			
12:44	43.14	20.3	13: 8	43.61	21.3			
13: 6	44.27	20.4	13:30	43.87	21.3			
13:27	42.82	20.6	13:51	43.26	21.4			
13:50	41.84	20.5	14:13	43.85	21.5			
14:10	41.75	20.7	14:35	44.09	21.6			
14:32	40.76	20.6	14:56	44.14	21.6			
14:53	41.87	20.7	15:18	45.03	21.6			
15:15	42.57	20.7	15:39	45.54	21.6			
15:36	45.00	20.8	16: 1	45.97	21.6			
15:58	46.85	20.9	16:22	46.57	21.6			
16:19	48.08	20.8	16:44	47.45	21.6			
16:41	50.06	21.1	17: 5	46.37	21.5			
17: 2	51.28	21.2	17:27	47.64	21.6			
17:25	50.95	21.2	17:48	46.92	21.6			
17:46	50.04	21.1	18:10	47.75	21.6			
18: 7	49.11	21.2	18:31	49.19	21.6			
18:29	47.32	21.3	18:53	50.44	21.6			
18:50	48.02	21.3	19:14	50.34	21.6			
19:12	47.77	21.5	19:36	46.41	21.6			
19:33	48.12	21.7	19:57	42.26	21.6			
19:55	48.24	21.6	20:19	25.79	21.3			
20:16	47.82	21.4	20:40	17.99	21.0			
20:38	48.05	21.4	21: 2	19.02	21.0			
21: 0	48.33	21.5	21:23	20.67	21.0			
21:21	50.20	21.5	21:45	20.73	21.0			
21:42	50.52	21.6	22: 7	19.12	20.7			
22: 4	50.63	21.3	22:28	18.86	20.8			
22:25	50.77	21.4	22:50	18.67	20.7			
22:47	50.50	21.5	23:11	18.45	20.5			
23: 9	50.66	21.5	23:33	18.63	20.4			
23:30	49.54	21.3	23:54	19.34	20.5			
23:52	47.95	21.3	0:16	19.25	20.4			

These data were collected under file SBT#44

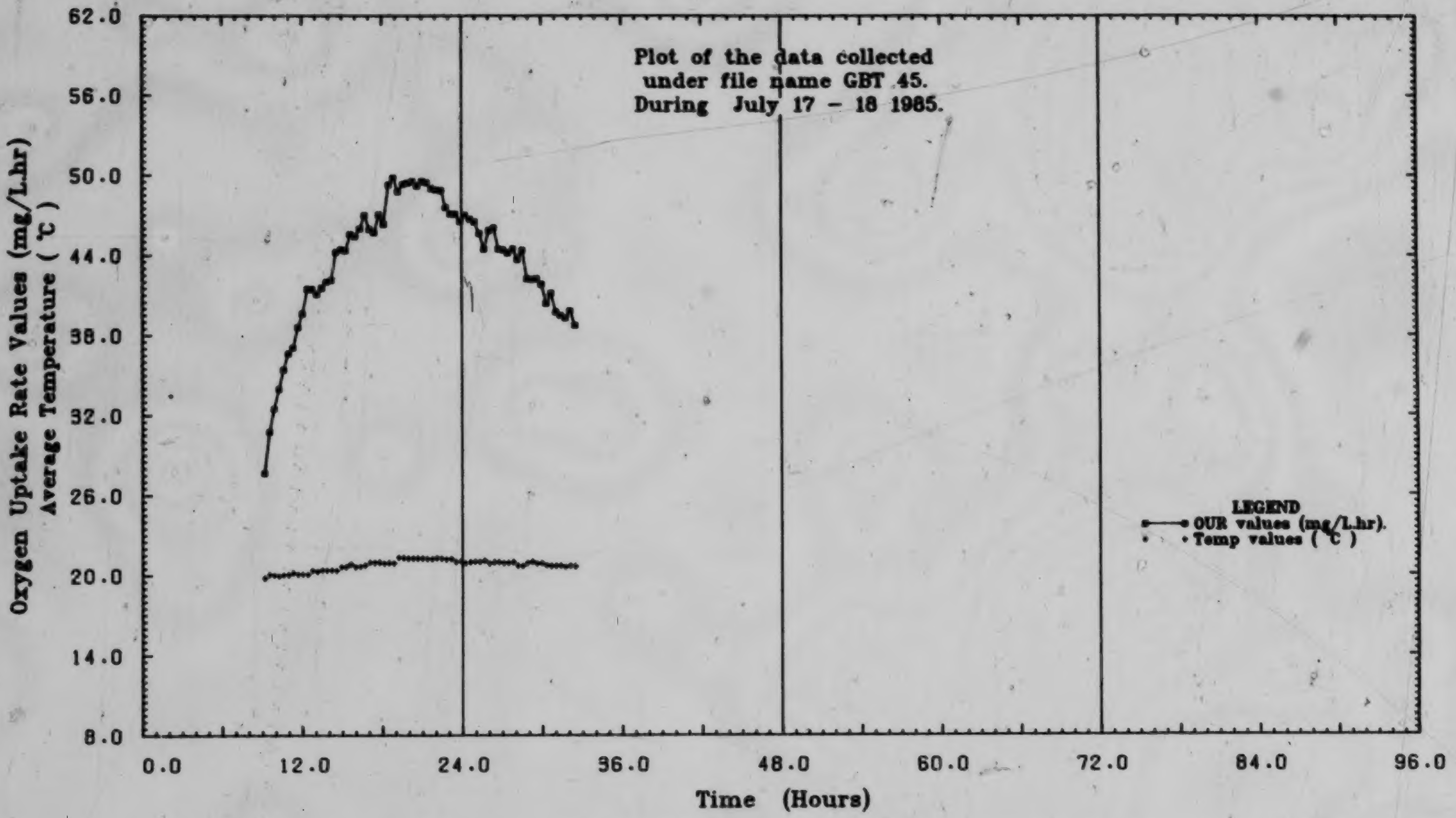


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 17-18 / 7 / 1988)

DAY 1			DAY 2		
17 7 88			18 7 88		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:13	46.99	21.0
			0:35	46.69	21.0
			0:56	46.47	21.1
			1:18	45.80	21.0
			1:39	44.44	21.1
			2: 1	45.82	20.9
			2:23	46.02	21.0
			2:44	44.45	21.0
			3: 6	44.39	21.0
			3:27	44.18	21.0
			3:50	44.44	21.0
			4:10	43.67	20.7
			4:32	44.34	20.7
			4:53	42.22	20.9
			5:15	42.17	21.1
			5:36	42.22	20.9
			5:58	41.79	20.9
			6:20	40.37	20.8
			6:41	41.11	20.7
			7: 3	39.71	20.7
			7:25	39.46	20.8
			7:46	39.27	20.8
			8: 7	39.79	20.7
			8:29	38.71	20.7
9: 9	27.70	19.8			
9:31	30.79	20.1			
9:52	32.52	20.1			
10:14	33.99	20.0			
10:35	35.45	20.1			
10:57	36.64	20.1			
11:18	37.09	20.2			
11:40	38.80	20.1			
12: 1	39.82	20.1			
12:23	41.48	20.1			
12:44	41.46	20.4			
13: 6	41.09	20.3			
13:28	41.55	20.4			
13:50	42.00	20.4			
14:11	42.14	20.4			
14:32	44.22	20.4			
14:54	44.41	20.7			
15:15	44.34	20.7			
15:37	45.53	20.9			
15:58	46.39	20.7			
16:20	45.95	20.7			
16:41	46.97	20.8			
17: 3	45.83	21.0			
17:25	45.88	21.0			
17:46	47.01	21.0			
18: 7	46.30	20.9			
18:29	48.25	21.0			
18:50	48.78	20.9			
19:12	46.75	21.4			
19:34	48.30	21.3			
19:55	48.40	21.3			
20:17	48.53	21.3			
20:38	48.18	21.3			
21: 0	48.54	21.3			
21:21	45.42	21.3			
21:43	46.96	21.3			
22: 4	46.88	21.3			
22:26	46.82	21.3			
22:47	47.58	21.2			
23: 9	47.08	21.3			
23:30	47.05	21.0			
23:52	46.50	21.1			

These data were collected under file GBT#45

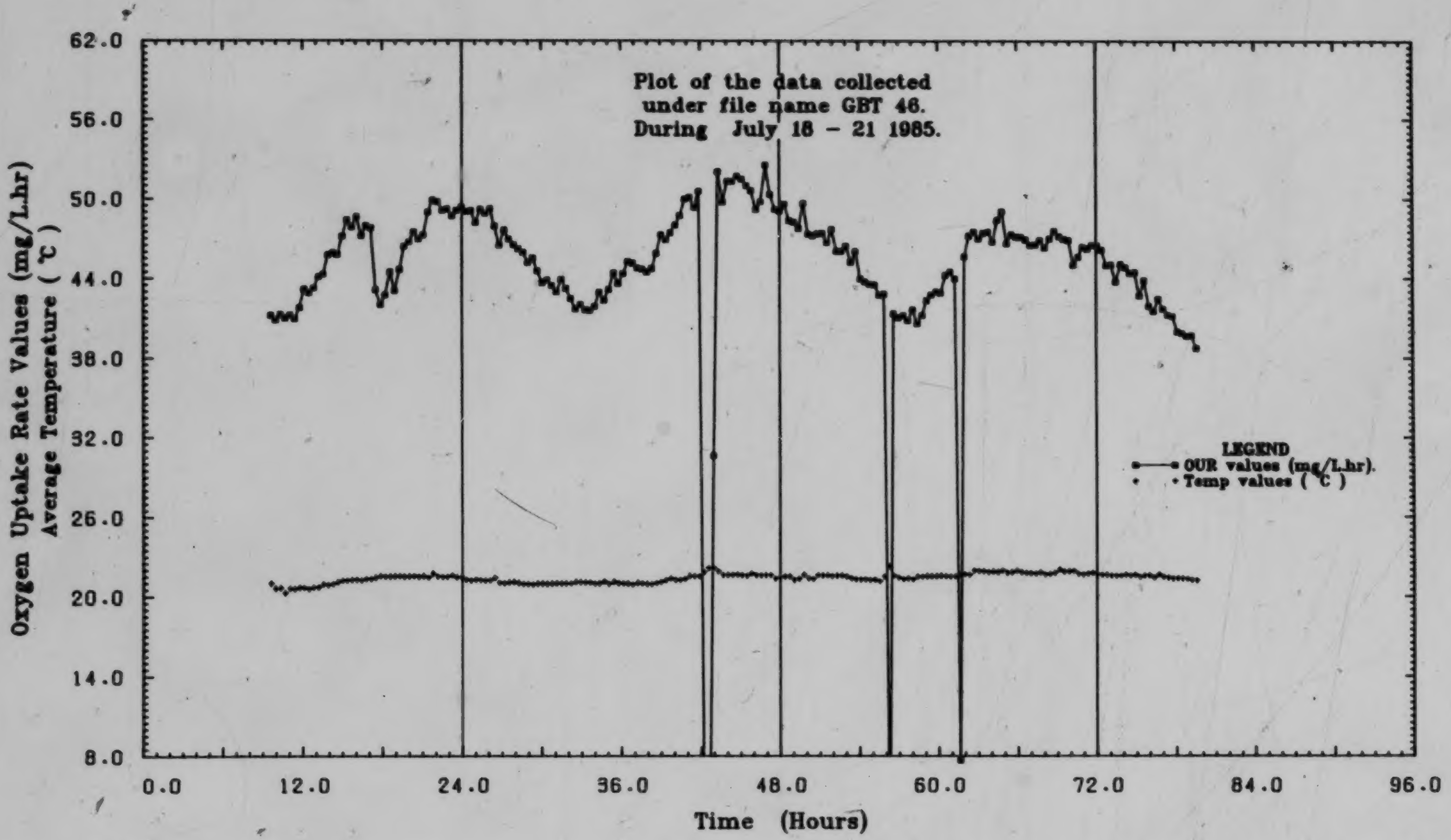


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 18-21 / 7 / 1985)

DAY 1			DAY 2			DAY 3			DAY 4		
18 7 85			19 7 85			20 7 85			21 7 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:17	49.01	21.3	0:20	49.57	21.6	0: 1	46.49	21.7
			0:39	49.06	21.3	0:42	48.34	21.5	0:22	46.18	21.7
			1: 0	48.17	21.3	1: 3	48.23	21.3	0:44	44.96	21.7
			1:22	49.17	21.3	1:25	47.75	21.4	1: 5	45.02	21.8
			1:43	48.57	21.3	1:46	49.63	21.7	1:27	43.75	21.8
			2: 5	49.20	21.3	2: 8	47.33	21.4	1:50	45.07	21.6
			2:26	47.80	21.5	2:29	47.21	21.3	2:10	44.83	21.7
			2:48	48.45	21.1	2:51	47.35	21.6	2:32	44.41	21.6
			3:10	47.80	21.0	3:12	47.39	21.8	2:53	44.44	21.7
			3:31	48.92	21.1	3:34	48.71	21.6	3:15	42.71	21.8
			3:53	46.50	21.1	3:55	47.67	21.6	3:36	43.65	21.8
			4:14	46.16	21.1	4:17	48.03	21.6	3:58	41.82	21.8
			4:36	45.91	21.0	4:39	48.03	21.8	4:19	41.53	21.8
			4:57	45.16	21.0	5: 0	48.41	21.5	4:41	42.43	21.7
			5:19	45.46	21.0	5:22	45.20	21.4	5: 2	41.70	21.5
			5:40	44.52	21.0	5:43	46.00	21.3	5:25	41.25	21.4
			6: 2	43.63	21.0	6: 5	43.94	21.3	5:46	41.14	21.4
			6:23	43.64	21.0	6:26	43.73	21.3	6: 7	40.00	21.4
			6:45	43.42	21.0	6:48	43.84	21.3	6:28	39.69	21.4
			7: 6	42.95	21.0	7: 9	43.50	21.3	6:50	39.57	21.3
			7:28	43.57	21.0	7:31	42.72	21.2	7:11	38.71	21.3
			7:50	43.20	21.0	7:52	42.79	21.6	7:33	38.75	21.3
			8:11	42.44	21.0	8:14	-0.50	22.3			
			8:32	41.66	21.1	8:35	41.31	21.6			
			8:54	42.00	21.1	8:57	41.02	21.4			
			9:15	41.80	21.1	9:19	41.18	21.3			
9:35	41.22	21.1	9:37	41.57	21.1	9:40	40.60	21.4			
9:56	40.67	20.7	10: 0	41.85	21.0	10: 2	41.61	21.3			
10:18	41.28	20.7	10:20	42.50	21.0	10:23	40.57	21.5			
10:39	41.01	20.3	10:42	42.30	21.2	10:45	41.19	21.5			
11: 1	41.23	20.7	11: 3	43.13	21.0	11: 6	42.31	21.6			
11:22	40.95	20.8	11:25	44.35	21.1	11:27	42.73	21.6			
11:44	41.80	20.7	11:46	43.56	21.0	11:50	42.99	21.8			
12: 5	43.18	20.7	12: 8	44.32	21.0	12:10	42.69	21.8			
12:27	42.90	20.6	12:29	45.22	21.0	12:32	44.22	21.6			
12:48	43.27	20.6	12:51	45.10	20.9	12:53	44.46	21.5			
13:10	44.11	20.8	13:13	44.73	21.1	13:15	43.95	21.5			
13:31	44.31	21.0	13:34	44.66	21.0	13:36	7.66	21.7			
13:53	45.74	20.9	13:56	44.43	21.0	13:58	45.63	21.7			
14:15	45.92	21.0	14:17	44.69	21.0	14:19	47.18	21.7			
14:36	45.77	21.1	14:39	45.63	21.0	14:41	47.49	22.0			
14:58	47.14	21.3	15: 0	47.25	21.1	15: 3	46.96	21.9			
15:19	48.38	21.3	15:22	46.57	21.3	15:25	47.41	21.8			
15:41	47.87	21.3	15:43	47.41	21.4	15:46	47.51	21.9			
16: 2	48.62	21.3	16: 5	48.00	21.3	16: 7	48.75	21.9			
16:25	47.19	21.3	16:26	48.70	21.3	16:29	46.40	21.9			
16:45	47.95	21.4	16:48	49.86	21.4	16:50	49.01	22.0			
17: 7	47.76	21.4	17: 9	50.11	21.6	17:12	46.62	21.6			
17:28	43.13	21.5	17:31	49.32	21.6	17:33	47.30	21.6			
17:50	42.00	21.6	17:52	50.55	21.5	17:55	47.11	22.0			
18:11	42.72	21.6	18:14	-0.51	21.9	18:16	47.10	21.8			
18:33	44.45	21.6	18:35	-1.52	22.2	18:38	45.91	21.8			
18:54	43.04	21.6	18:57	30.61	22.2	19: 0	46.49	21.8			
19:16	44.62	21.6	19:18	52.04	21.9	19:21	46.63	21.6			
19:37	46.38	21.6	19:40	48.75	21.6	19:42	46.67	21.9			
20: 0	46.72	21.6	20: 1	51.32	21.6	20: 4	46.31	21.7			
20:20	47.45	21.6	20:23	51.32	21.7	20:26	46.96	21.7			
20:42	46.94	21.5	20:45	51.71	21.7	20:47	47.55	21.6			
21: 3	47.24	21.6	21: 6	51.47	21.6	21: 9	47.17	22.1			
21:25	46.95	21.5	21:28	50.96	21.6	21:30	46.97	21.9			
21:46	49.66	21.6	21:50	50.60	21.8	21:52	46.86	21.9			
22: 8	48.76	21.5	22:11	49.16	21.6	22:13	45.02	22.0			
22:30	49.09	21.5	22:32	48.77	21.6	22:35	45.61	21.7			
22:51	49.20	21.6	22:54	52.54	21.6	22:56	48.36	21.7			
23:13	48.66	21.7	23:15	50.33	21.6	23:18	46.22	21.8			
23:34	49.06	21.5	23:37	49.19	21.4	23:39	46.50	21.6			
23:56	49.37	21.5	23:58	49.07	21.4	0: 1	46.49	21.7			

These data were collected under file SBT#46



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

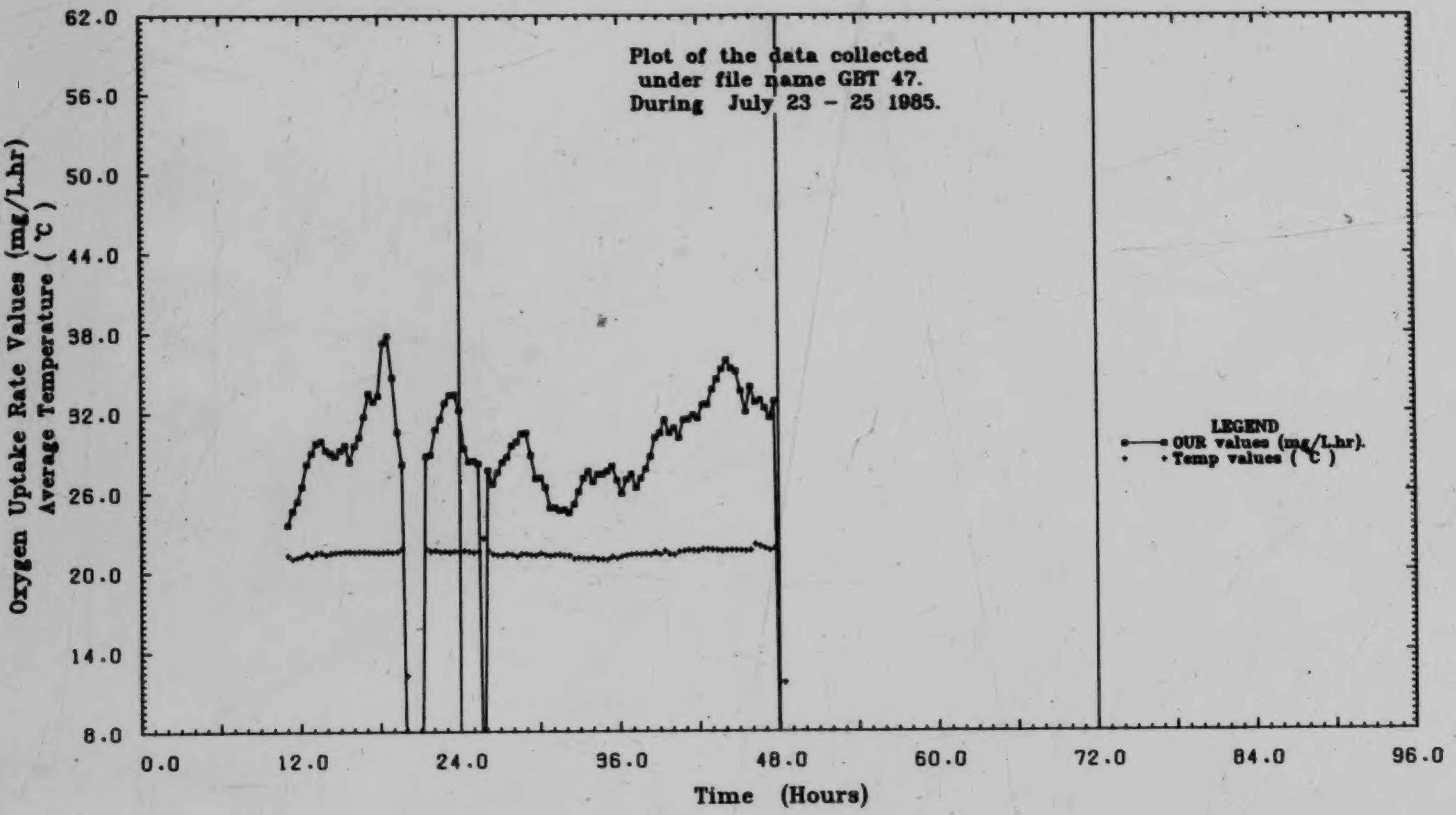
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 23-25 / 7 / 1985)

DAY 1 23 7 85			DAY 2 24 7 85			DAY 3 25 7 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:18	29.34	21.7	0: 2	0.08	11.7
			0:40	28.38	21.8	0:23	0.10	11.7
			1: 1	28.40	21.5	0:45	0.91	1.4
			1:23	28.19	21.6	1: 7	1.24	-3.9
			1:45	-0.37	22.8	1:28	0.74	1.8
			2: 6	27.69	21.6	1:50	1.12	1.6
			2:28	28.67	21.4	2:11	0.80	1.1
			2:50	27.52	21.3	2:33	0.63	1.6
			3:11	28.28	21.3	2:54	0.65	1.7
			3:32	28.66	21.4	3:16	1.21	-3.9
			3:54	29.50	21.4	3:38	0.12	-3.5
			4:15	29.81	21.2	4: 0	0.88	-3.6
			4:37	30.40	21.4	4:21	0.0	-3.7
			5: 0	30.47	21.4	4:42	0.35	-3.6
			5:20	28.79	21.3	5: 4	0.47	-3.5
			5:42	27.08	21.3	5:25	-0.53	-3.6
			6: 3	27.10	21.4	5:47	-0.39	-3.5
			6:25	28.38	21.3	6: 8	0.20	-3.5
			6:47	24.85	21.2	6:30	-1.15	-3.5
			7: 8	24.85	21.3	6:51	-0.08	-3.4
			7:30	24.66	21.3	7:13	-0.10	-3.5
			7:51	24.89	21.3	7:35	-0.14	-3.2
			8:13	24.46	21.3	7:56	-0.13	-3.1
			8:35	25.10	21.0	8:18	-0.84	-3.4
			8:56	26.04	21.1	8:39	-1.05	-3.6
			9:18	27.08	21.0	9: 1	0.07	-3.5
			9:39	27.57	21.0	9:22	-1.53	-3.4
			10: 1	28.79	21.1	9:44	-0.03	-3.2
			10:22	27.37	21.0	10: 6	0.04	-3.2
			10:44	27.37	21.0	10:27	-0.16	-3.1
			11: 5	27.58	20.9	10:50	-0.88	-3.3
11: 1	23.81	21.3	11:27	27.85	21.1			
11:22	24.66	21.1	11:50	28.90	21.0			
11:44	25.40	21.2	12:10	25.80	21.2			
12: 5	26.52	21.3	12:32	28.95	21.3			
12:27	28.20	21.5	12:53	27.34	21.3			
12:50	29.01	21.3	13:15	26.33	21.4			
13:10	29.74	21.5	13:36	27.03	21.3			
13:32	28.93	21.5	13:58	27.71	21.4			
13:53	29.23	21.4	14:20	28.64	21.3			
14:15	29.02	21.5	14:41	30.07	21.5			
14:36	28.60	21.6	15: 3	30.40	21.3			
14:58	29.20	21.6	15:25	31.40	21.6			
15:20	29.58	21.6	15:46	30.43	21.3			
15:41	28.38	21.6	16: 7	30.77	21.3			
16: 3	29.57	21.5	16:29	30.05	21.5			
16:25	30.20	21.6	16:51	31.41	21.6			
16:46	31.75	21.6	17:12	31.45	21.6			
17: 7	33.48	21.6	17:34	31.78	21.6			
17:28	32.88	21.6	17:55	31.51	21.6			
17:50	33.31	21.6	18:17	32.52	21.7			
18:12	37.26	21.6	18:38	32.86	21.7			
18:33	37.80	21.6	19: 0	33.88	21.5			
18:55	34.68	21.6	19:21	34.64	21.6			
19:17	30.57	21.6	19:43	35.22	21.6			
19:38	28.15	21.9	20: 5	35.87	21.6			
20: 0	1.09	12.2	20:26	35.28	21.6			
20:21	1.51	-3.6	20:48	35.04	21.6			
20:43	1.01	-3.6	21: 9	33.57	21.6			
21: 4	1.21	-3.5	21:31	32.01	21.6			
21:26	28.76	21.6	21:52	33.86	21.6			
21:47	28.87	21.6	22:14	32.74	22.1			
22: 9	30.75	21.7	22:36	32.86	21.9			
22:31	31.51	21.6	22:57	32.29	21.6			
22:52	32.75	21.9	23:19	31.58	21.6			
23:14	33.33	21.5	23:40	32.81	21.6			
23:35	33.37	21.6	0: 2	0.08	11.7			
23:57	32.21	21.6	0:23	0.10	11.7			

These data were collected under file SBT#47

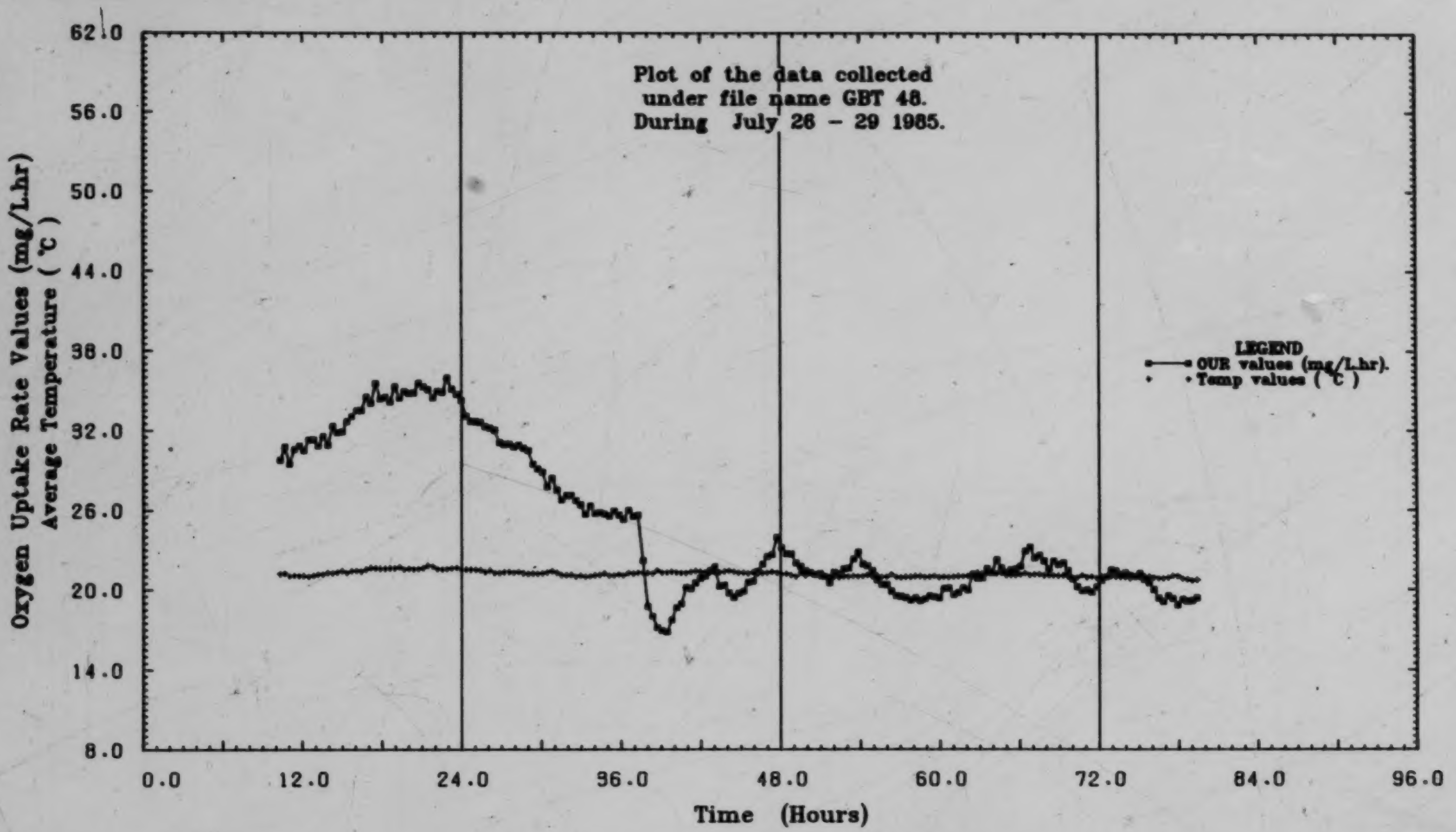


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 26-29 / 7 / 1985)

DAY 1 26 7 85			DAY 2 27 7 85			DAY 3 28 7 85			DAY 4 29 7 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:19	33.05	21.6	0: 2	23.18	21.2	0: 7	20.71	21.0
			0:40	32.86	21.6	0:25	22.71	21.2	0:29	20.99	20.9
			1: 2	32.88	21.6	0:45	22.88	21.1	0:50	21.51	21.1
			1:23	32.61	21.5	1: 7	22.01	21.0	1:12	21.48	21.0
			1:45	32.29	21.4	1:28	21.74	21.3	1:33	21.18	21.0
			2: 6	32.18	21.5	1:50	21.42	21.1	1:55	21.29	21.0
			2:28	32.01	21.3	2:12	21.27	21.3	2:16	21.10	20.9
			2:50	31.08	21.3	2:33	21.14	21.1	2:38	21.01	21.0
			3:11	30.93	21.4	2:55	21.21	21.0	3: 0	21.25	21.0
			3:33	30.98	21.4	3:16	20.89	21.0	3:21	20.79	21.1
			3:54	30.75	21.3	3:36	20.51	21.0	3:43	20.53	21.0
			4:16	30.89	21.4	4: 0	21.31	21.0	4: 4	20.02	20.9
			4:37	30.86	21.3	4:21	21.22	20.9	4:26	19.65	20.9
			5: 0	30.48	21.2	4:43	21.55	21.0	4:47	19.11	20.9
			5:21	29.45	21.3	5: 4	21.62	21.0	5: 9	19.59	20.9
			5:42	29.11	21.2	5:26	22.31	21.0	5:30	19.35	21.1
			6: 4	28.67	21.3	5:47	22.83	21.0	5:52	18.89	21.1
			6:25	27.78	21.3	6: 9	21.93	21.0	6:14	19.30	20.9
			6:47	28.41	21.4	6:30	21.60	21.1	6:35	19.15	20.8
			7: 9	27.52	21.3	6:52	21.42	21.0	6:57	19.20	20.7
			7:30	28.79	21.1	7:14	20.73	21.1	7:18	19.40	20.8
			7:52	27.13	21.1	7:35	20.37	21.0			
			8:13	27.13	21.1	7:57	20.37	21.0			
			8:35	26.73	21.0	8:18	19.88	21.2			
			8:56	26.41	21.1	8:40	19.55	21.0			
			9:18	25.70	21.0	9: 1	19.50	20.9			
			9:40	26.32	21.0	9:23	19.40	21.0			
			10: 1	25.75	21.1	9:45	19.21	21.0			
10:18	29.78	21.2	10:23	25.61	21.1	10: 6	19.38	21.0			
10:39	30.78	21.3	10:44	25.70	21.3	10:28	19.18	21.0			
11: 1	29.49	21.1	11: 6	25.65	21.1	10:50	19.32	21.0			
11:22	30.80	21.1	11:27	25.54	21.1	11:11	19.55	21.0			
11:44	30.67	21.1	11:50	25.62	21.2	11:32	19.48	21.1			
12: 5	30.51	21.1	12:10	25.30	21.1	11:54	19.39	20.9			
12:27	31.31	21.0	12:32	25.59	21.3	12:15	20.09	21.0			
12:50	31.33	21.1	12:54	25.53	21.2	12:37	20.12	21.0			
13:10	30.86	21.2	13:15	25.61	21.3	13: 0	19.82	21.0			
13:32	31.57	21.2	13:37	22.20	21.3	13:20	19.79	21.0			
13:53	30.92	21.3	13:58	18.75	21.3	13:42	20.14	21.0			
14:15	32.33	21.3	14:20	18.01	21.2	14: 3	19.98	21.1			
14:36	31.66	21.4	14:41	17.18	21.5	14:25	21.18	21.1			
14:58	31.81	21.5	15: 3	16.94	21.3	14:46	20.88	21.3			
15:19	32.69	21.3	15:25	16.86	21.3	15: 8	20.90	21.3			
15:41	33.06	21.5	15:46	17.75	21.4	15:30	21.59	21.3			
16: 3	33.61	21.5	16: 8	18.66	21.3	15:51	21.29	21.4			
16:25	33.52	21.4	16:29	18.96	21.3	16:13	22.27	21.3			
16:46	34.52	21.6	16:51	20.18	21.3	16:34	21.65	21.3			
17: 7	34.05	21.7	17:13	20.09	21.4	16:56	21.32	21.1			
17:29	35.53	21.7	17:34	20.50	21.4	17:17	21.50	21.1			
17:50	34.38	21.6	17:56	20.86	21.4	17:39	21.56	21.1			
18:12	34.49	21.6	18:17	21.03	21.3	18: 1	21.76	21.2			
18:34	34.19	21.7	18:39	21.44	21.3	18:22	22.83	21.3			
18:55	35.28	21.7	19: 0	21.73	21.3	18:44	23.22	21.1			
19:17	34.44	21.8	19:22	20.27	21.3	19: 5	22.41	21.2			
19:38	34.93	21.6	19:44	20.34	21.4	19:27	22.61	21.2			
20: 0	34.79	21.6	20: 5	19.79	21.4	19:48	22.18	21.1			
20:21	34.63	21.6	20:27	19.43	21.4	20:10	21.57	21.1			
20:43	35.55	21.6	20:48	19.76	21.3	20:31	22.17	21.1			
21: 5	35.29	21.7	21:10	19.86	21.3	20:53	21.81	21.1			
21:26	35.07	21.8	21:31	20.55	21.2	21:15	22.04	21.1			
21:48	34.46	21.6	21:53	20.62	21.3	21:36	21.45	21.0			
22: 9	34.94	21.8	22:14	21.37	21.2	21:58	20.82	20.9			
22:31	34.86	21.6	22:36	21.93	21.3	22:19	20.23	21.0			
22:52	35.94	21.6	22:57	22.49	21.3	22:41	19.94	21.1			
23:14	35.11	21.7	23:19	22.84	21.4	23: 2	19.99	21.0			
23:36	34.89	21.7	23:41	23.94	21.3	23:25	19.84	21.0			
23:57	34.24	21.6	0: 2	23.18	21.2	23:46	20.23	20.9			

These data were collected under file GBT#48

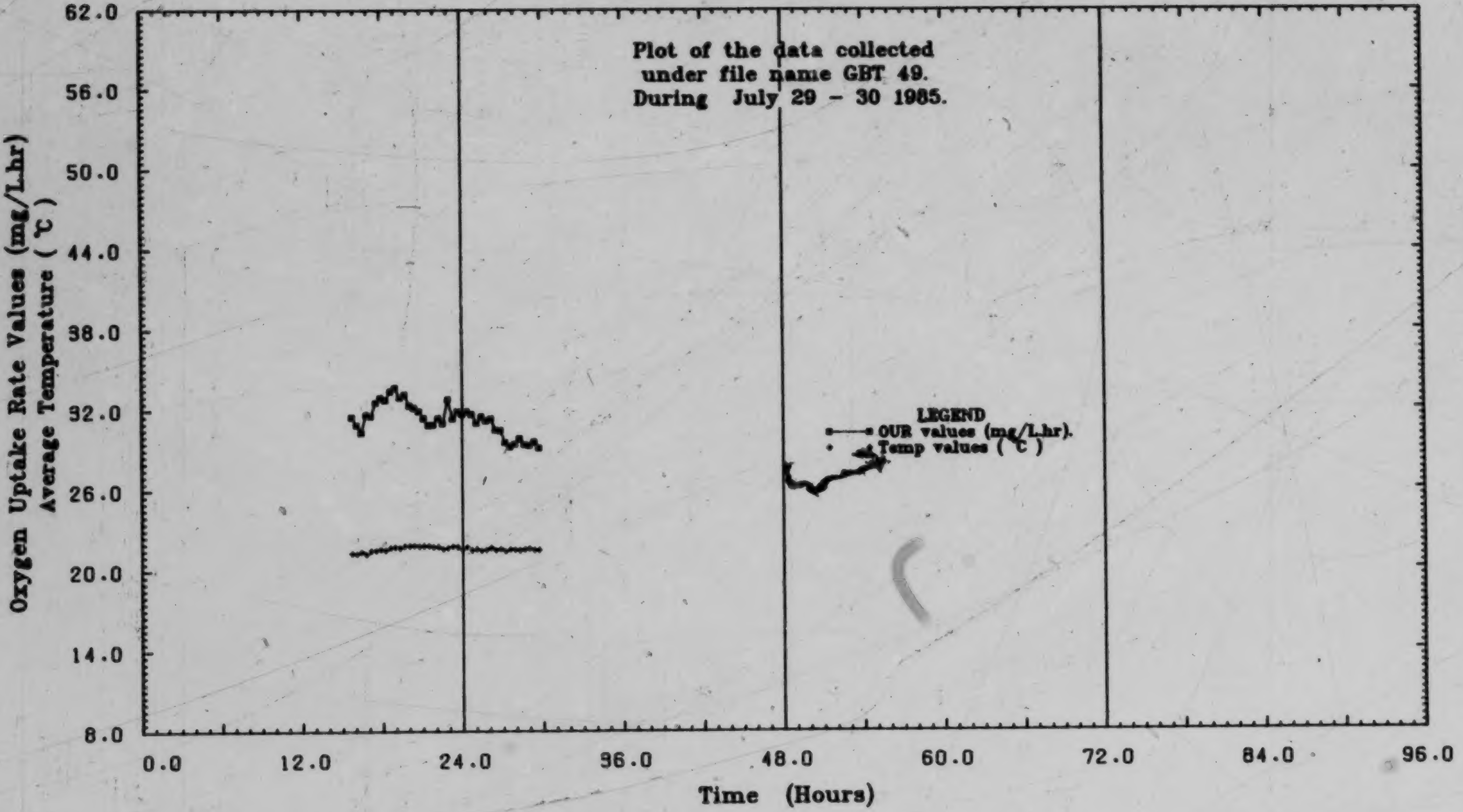


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 29-30 / 7 / 1985)

DAY 1 29 7 85			DAY 2 30 7 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:19	31.91	21.8
			0:41	31.89	21.8
			1: 2	31.06	21.7
			1:25	31.54	21.8
			1:46	31.22	21.8
			2: 7	31.34	21.8
			2:28	30.53	21.8
			2:50	30.49	21.7
			3:11	29.58	21.8
			3:33	29.27	21.8
			3:54	29.45	21.8
			4:16	29.87	21.8
			4:38	29.41	21.8
			5: 0	29.36	21.7
			5:21	29.63	21.8
			5:42	29.18	21.9
15:42	31.51	21.5			
16: 4	30.91	21.3			
16:25	30.35	21.5			
16:47	31.69	21.3			
17: 8	31.59	21.5			
17:30	32.60	21.6			
17:51	32.94	21.7			
18:13	32.80	21.8			
18:35	33.43	21.8			
18:56	33.70	21.8			
19:18	32.98	21.8			
19:39	33.19	21.9			
20: 1	32.36	21.9			
20:22	32.19	21.9			
20:44	31.94	21.9			
21: 5	31.41	21.9			
21:27	30.90	21.9			
21:48	30.94	21.8			
22:10	31.42	21.8			
22:31	31.04	21.7			
22:53	32.63	21.8			
23:15	31.36	21.9			
23:36	31.92	21.8			
23:58	31.71	21.8			

These data were collected under file GBT#49

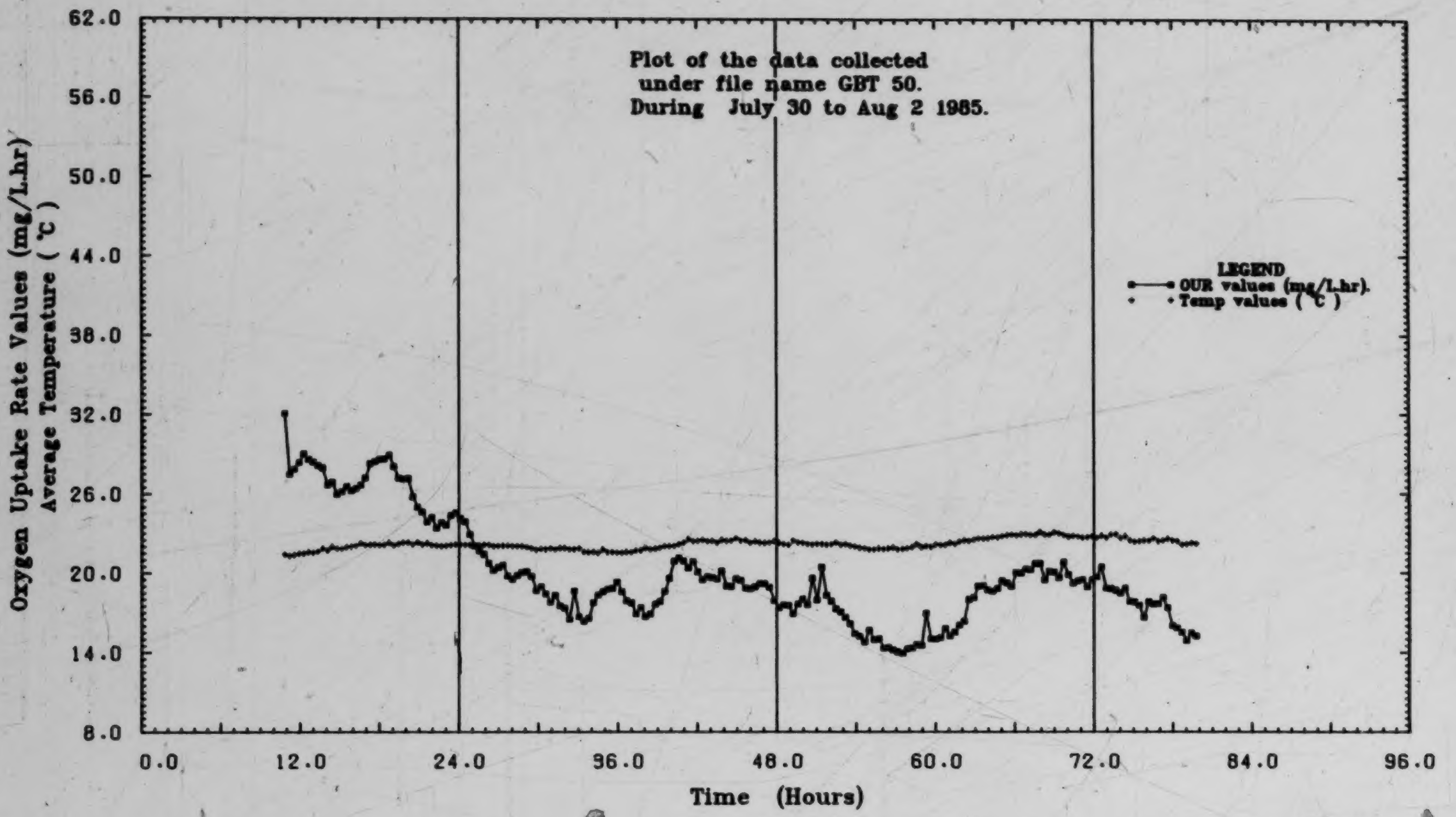


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of July 30 to August 2 1985)

DAY 1 30 7 85			DAY 2 31 7 85			DAY 3 1 8 85			DAY 4 2 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 5	24.15	22.2	0: 9	17.35	22.3	0:12	19.74	22.7
			0:27	23.91	22.2	0:30	17.56	22.2	0:33	20.46	22.8
			0:50	22.95	22.2	0:52	17.55	22.2	0:55	18.86	22.7
			1:10	22.09	22.2	1:13	18.04	22.5	1:15	18.84	22.9
			1:32	21.72	22.2	1:35	17.66	22.3	1:38	18.70	23.0
			1:53	21.45	22.2	1:56	18.03	22.3	2: 0	18.49	22.7
			2:15	20.77	22.2	2:18	17.80	22.2	2:21	18.88	22.8
			2:36	20.25	22.1	2:40	18.61	22.2	2:43	17.88	22.5
			2:58	20.46	22.1	3: 1	17.96	22.3	3: 4	17.82	22.4
			3:19	20.52	22.1	3:23	20.42	22.3	3:26	17.56	22.4
			3:41	19.61	22.1	3:44	18.31	22.3	3:47	18.66	22.5
			4: 2	19.55	22.1	4: 5	17.88	22.2	4: 9	17.84	22.5
			4:25	19.85	22.1	4:27	17.26	22.3	4:30	17.68	22.7
			4:45	20.06	22.1	4:50	17.05	22.2	4:52	17.70	22.4
			5: 7	20.13	22.0	5:10	16.65	22.2	5:14	18.15	22.5
			5:28	19.78	21.9	5:32	16.15	22.1	5:35	17.34	22.6
			5:50	18.70	21.8	5:53	15.43	22.0	5:57	18.04	22.5
			6:12	18.99	21.9	6:15	15.23	21.9	6:18	15.67	22.4
			6:33	18.45	21.8	6:37	14.60	21.9	6:40	15.54	22.2
			6:55	17.63	21.9	6:58	15.66	21.8	7: 1	14.92	22.2
			7:16	18.34	21.8	7:20	14.97	21.8	7:23	15.48	22.3
			7:38	17.54	21.9	7:41	15.03	21.8	7:45	15.28	22.2
			8: 0	17.37	21.9	8: 3	14.35	21.8			
			8:21	18.51	21.8	8:25	14.34	21.9			
			8:42	18.65	21.8	8:46	14.20	22.0			
			9: 4	16.73	21.9	9: 7	14.06	21.8			
			9:26	16.37	21.8	9:29	13.95	21.8			
			9:47	18.60	21.8	9:50	14.30	21.8			
			10: 9	17.78	21.9	10:12	14.35	22.0			
10:50	32.09	21.5	10:30	18.37	21.9	10:33	14.61	22.2			
11:11	27.53	21.4	10:52	18.50	21.8	10:55	14.56	22.0			
11:32	27.85	21.4	11:13	18.80	21.9	11:16	15.95	22.1			
11:54	28.40	21.5	11:35	16.64	21.9	11:38	15.05	22.0			
12:15	29.05	21.5	11:56	19.32	21.9	12: 0	15.03	22.2			
12:37	28.64	21.6	12:18	18.60	21.8	12:21	15.14	22.2			
12:58	28.43	21.6	12:39	17.81	21.8	12:43	15.83	22.2			
13:20	28.16	21.7	13: 1	17.76	21.8	13: 4	15.26	22.3			
13:41	27.98	21.8	13:22	18.84	21.7	13:26	15.57	22.2			
14: 3	26.71	21.8	13:44	17.39	21.7	13:47	16.09	22.4			
14:25	28.80	22.0	14: 5	16.73	21.9	14: 9	16.37	22.5			
14:46	28.01	21.9	14:27	16.93	21.8	14:30	16.01	22.6			
15: 8	28.20	21.9	14:50	17.65	21.9	14:52	16.15	22.5			
15:29	28.58	22.0	15:10	17.85	21.9	15:13	19.02	22.6			
15:51	26.29	22.1	15:32	18.61	22.1	15:35	19.05	22.6			
16:12	26.44	22.1	15:53	19.82	22.0	15:56	18.74	22.7			
16:34	26.71	22.3	16:15	20.80	22.1	16:18	16.83	22.7			
16:55	27.23	22.2	16:36	21.14	22.2	16:40	18.85	22.7			
17:17	28.30	22.2	16:58	20.91	22.3	17: 1	19.43	22.8			
17:38	28.47	22.2	17:19	20.40	22.6	17:23	19.26	22.9			
18: 0	28.64	22.2	17:41	20.87	22.4	17:44	19.01	22.9			
18:21	28.86	22.2	18: 2	20.10	22.5	18: 6	20.05	22.9			
18:43	28.95	22.3	18:25	19.50	22.5	18:27	20.00	22.9			
19: 4	28.06	22.1	18:46	19.73	22.4	18:50	20.30	23.0			
19:26	27.22	22.3	19: 7	19.86	22.5	19:10	20.27	22.9			
19:47	27.14	22.4	19:29	19.56	22.3	19:32	20.73	22.9			
20: 9	27.19	22.4	19:50	20.13	22.5	19:53	20.74	23.1			
20:30	25.81	22.2	20:12	19.02	22.4	20:15	19.50	22.9			
20:52	25.01	22.4	20:33	18.99	22.5	20:36	20.13	22.9			
21:13	24.85	22.2	20:55	19.59	22.6	20:58	20.06	23.1			
21:35	23.90	22.3	21:16	18.44	22.6	21:20	19.87	23.0			
21:56	24.21	22.2	21:38	18.86	22.5	21:41	20.83	22.9			
22:18	23.44	22.1	22: 0	18.61	22.3	22: 3	19.89	22.8			
22:40	23.85	22.1	22:21	18.88	22.4	22:25	19.24	22.8			
23: 1	23.86	22.1	22:43	19.21	22.3	22:46	19.42	22.8			
23:23	24.39	22.2	23: 4	19.19	22.3	23: 7	19.50	22.7			
23:44	24.59	22.2	23:26	18.92	22.3	23:29	18.98	22.7			

These data were collected under file GST#50



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 2- 5 / 6 / 1985)

DAY 1			DAY 2			DAY 3			DAY 4		
2 6 85			3 6 85			4 6 85			5 6 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 2	25.85	23.0	0: 5	20.27	22.8	0: 7	18.29	22.4
			0:23	25.06	23.0	0:26	20.29	23.0	0:29	17.25	22.3
			0:45	25.13	23.0	0:48	19.88	23.0	0:50	17.72	22.1
			1: 6	25.13	23.1	1: 9	22.90	22.9	1:12	17.90	22.4
			1:28	25.60	23.0	1:31	19.79	23.0	1:34	18.22	22.3
			1:50	24.27	23.2	1:52	21.11	23.0	1:55	19.70	22.2
			2:11	24.51	23.1	2:14	18.83	22.0	2:17	18.21	22.3
			2:33	23.87	23.0	2:35	20.70	22.1	2:38	18.82	22.0
			2:54	23.90	23.1	2:57	20.04	23.0	3: 0	18.26	21.9
			3:16	24.56	23.0	3:18	19.89	22.8	3:21	18.67	21.9
			3:37	23.19	23.0	3:40	18.42	22.7	3:43	17.20	22.0
			4: 0	22.89	22.7	4: 2	18.84	22.7	4: 4	16.33	21.8
			4:20	22.99	22.9	4:23	19.02	22.6	4:26	16.63	21.9
			4:42	22.62	22.8	4:45	18.38	22.8	4:47	15.54	21.9
			5: 3	22.15	23.0	5: 6	18.54	22.8	5: 9	15.67	21.9
			5:25	22.53	22.9	5:28	19.27	22.8	5:30	15.63	21.8
			5:46	21.96	22.8	5:50	19.27	22.5	5:52	15.33	21.9
			6: 8	21.69	22.7	6:11	20.41	22.8	6:14	15.23	21.9
			6:29	21.32	22.7	6:32	20.13	22.8	6:35	15.59	21.9
			6:51	20.93	23.0	6:54	19.40	22.6	6:57	14.84	21.9
			7:13	21.55	22.8	7:15	19.83	22.8	7:18	14.80	21.7
			7:34	20.86	22.8	7:37	19.36	22.6	7:40	15.00	21.7
			7:56	20.92	22.8	8: 0	18.77	22.9	8: 1	15.14	21.8
			8:17	20.79	22.7	8:20	17.53	22.8	8:23	15.40	21.8
			8:39	20.85	22.7	8:42	21.35	22.5	8:44	15.02	21.8
			9: 0	21.05	22.7	9: 3	17.02	22.7	9: 6	14.85	21.8
			9:22	20.75	22.7	9:25	17.88	22.4	9:27	15.00	21.8
			9:43	19.87	22.8	9:46	17.12	22.8	9:50	15.26	21.8
			10: 5	19.96	22.7	10: 8	17.32	22.5	10:10	14.32	22.0
			10:26	19.89	22.7	10:29	18.42	22.5	10:32	14.05	21.9
			10:48	20.83	22.7	10:51	19.02	22.6	10:54	14.52	21.9
			11:10	20.26	22.8	11:12	18.38	22.5	11:15	14.70	21.9
			11:31	20.21	22.9	11:34	18.08	22.9	11:37	14.89	21.9
			11:53	20.19	22.9	11:55	18.20	22.5	11:58	14.88	21.9
			12:14	20.22	22.7	12:17	17.48	22.5	12:20	15.51	21.9
			12:36	21.26	22.8	12:38	18.86	22.8	12:41	15.86	21.9
			12:57	21.28	23.1	13: 0	18.90	22.5	13: 3	15.88	21.9
			13:19	22.95	23.1	13:22	19.21	22.6	13:25	16.20	21.9
			13:40	21.98	23.1	13:43	18.20	22.7	13:46	16.23	21.9
			14: 2	21.44	23.0	14: 5	18.79	22.6	14: 7	16.32	21.8
			14:23	22.98	23.1	14:26	18.08	22.7	14:28	15.74	21.9
			14:45	24.12	23.0	14:48	17.79	22.8	14:50	16.31	22.0
			15: 7	21.23	23.0	15: 9	19.05	22.6	15:12	17.19	22.0
			15:28	22.03	23.1	15:31	19.04	23.0	15:34	17.18	22.2
			15:50	22.38	23.1	15:52	19.75	22.6	15:55	17.45	22.0
			16:11	22.54	23.1	16:14	18.75	22.8	16:17	16.85	21.9
			16:33	21.61	23.0	16:35	18.77	22.8	16:38	17.23	22.1
			16:54	21.46	23.0	16:57	19.22	22.8	17: 0	17.38	22.1
			17:16	22.32	23.0	17:18	21.16	22.7	17:21	17.52	22.3
			17:37	22.47	23.2	17:40	18.87	22.5	17:43	16.84	22.2
			18: 0	22.28	23.2	18: 1	18.82	22.4	18: 4	18.21	22.1
			18:20	21.41	23.1	18:23	19.02	22.6	18:26	17.27	22.1
			18:42	22.74	23.1	18:45	22.11	22.5	18:47	17.88	22.3
			19: 3	22.22	18.5	19: 6	18.70	22.5	19: 9	17.77	22.0
			19:25	21.63	23.2	19:28	19.12	22.4	19:30	17.83	22.1
			19:47	21.42	23.2	19:50	19.02	22.5	19:52	19.27	22.0
			20: 8	22.34	23.1	20:11	18.78	22.5	20:13	17.30	22.0
			20:30	23.04	23.3	20:32	19.23	22.5	20:35	18.61	22.3
			20:51	22.39	23.1	20:54	19.81	22.4	20:57	17.63	22.1
			21:13	21.04	23.1	21:15	18.79	22.5			
21:53	28.42	23.3	21:34	22.03	23.1	21:37	18.82	22.6			
22:14	28.08	23.2	21:56	21.84	22.9	21:58	18.35	22.5			
22:36	28.34	23.3	22:17	20.17	23.1	22:20	18.09	22.5			
22:57	27.88	23.2	22:39	20.44	22.9	22:41	18.18	22.4			
23:19	27.51	23.2	23: 0	20.67	23.0	23: 3	18.83	22.4			
23:40	27.81	23.1	23:22	20.63	23.2	23:25	17.27	22.4			

These data were collected under file name GBT#51

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 15-18 / 5 / 1985)

DAY 1 15 5 85			DAY 2 16 5 85			DAY 3 17 5 85			DAY 4 18 5 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 7	40.55	19.2	0:14	-0.39	20.6	0:16	36.10	19.8
			0:29	40.59	19.3	0:35	38.13	19.8	0:38	35.74	19.7
			0:50	40.61	19.2	0:57	37.75	19.7	1: 0	35.05	19.8
			1:12	38.26	19.3	1:18	37.16	19.6	1:21	34.66	19.7
			1:33	34.39	19.3	1:40	38.89	19.7	1:43	35.16	19.5
			1:55	28.84	19.2	2: 1	38.97	19.9	2: 4	35.32	19.5
			2:16	24.59	19.3	2:23	0.86	20.4	2:26	34.56	19.6
			2:38	0.41	20.0	2:44	37.09	19.6	2:47	34.95	19.5
			3: 0	21.73	19.5	3: 6	1.88	20.8	3: 9	34.50	19.6
			3:21	21.16	19.5	3:27	1.03	21.3	3:30	35.32	19.6
			3:42	21.42	19.5	3:49	35.32	19.6	3:52	33.85	19.5
			4: 4	22.02	19.3	4:10	16.90	20.0	4:13	33.95	19.4
			4:25	21.31	19.2	4:32	34.96	19.9	4:35	33.35	19.5
			4:47	21.72	19.3	4:54	0.87	19.8	4:56	34.19	19.5
			5: 8	21.90	19.2	5:15	34.40	19.6	5:18	33.74	19.2
			5:30	22.28	19.2	5:37	32.77	19.6	5:39	33.09	19.3
			5:52	22.71	19.3	5:58	32.47	19.5	6: 1	33.87	19.4
			6:13	22.42	19.2	6:20	32.90	19.5	6:22	32.22	19.2
			6:35	22.22	19.2	6:41	32.19	19.5	6:44	32.03	19.2
			6:56	22.77	19.2	7: 3	31.65	19.6	7: 5	32.24	19.3
			7:18	22.54	19.3	7:25	32.31	19.6	7:27	31.51	19.2
			7:39	22.04	19.2	7:46	31.06	19.6	7:48	31.82	19.2
			8: 1	22.26	19.3	8: 8	30.97	19.6	8:10	31.23	19.2
			8:22	22.01	19.2	8:29	30.89	19.5	8:31	31.23	19.2
			8:44	21.32	19.2	8:51	30.23	19.5	8:53	31.02	19.3
			9: 5	21.49	19.3	9:12	29.85	19.5	9:14	30.31	19.3
			9:27	21.19	19.2	9:34	29.28	19.4	9:36	31.22	19.3
			9:48	20.73	19.3	9:55	29.11	19.3	9:58	30.22	19.3
			10:10	20.74	19.2	10:17	28.79	19.3	10:19	31.39	19.3
10:29	26.40	17.3	10:56	20.46	19.1	10:38	28.90	19.3	10:41	30.82	19.3
10:51	26.19	17.2	11:18	20.31	19.0	11: 0	29.29	19.4	11: 2	30.85	19.3
11:12	27.17	17.2	11:40	21.68	19.0	11:21	29.40	19.3	11:25	31.11	19.2
11:34	27.83	17.3	12: 1	22.88	18.9	11:43	28.92	19.4	11:46	31.36	19.3
11:55	27.53	17.4	12:22	23.82	18.9	12: 4	29.34	19.3	12: 7	31.15	19.4
12:17	27.81	17.4	12:44	24.79	19.0	12:26	29.27	19.4	12:28	31.81	19.6
12:38	28.24	17.6	13: 5	25.80	19.2	12:48	28.73	19.4	12:50	32.21	19.6
13: 0	29.09	17.8	13:27	26.66	19.1	13: 9	29.90	19.6	13:11	32.43	19.5
13:21	29.93	17.7	13:49	28.22	19.4	13:31	30.22	19.6	13:33	32.32	19.3
13:43	31.03	17.8	14:11	29.48	19.4	13:52	30.61	19.5	13:54	32.24	19.4
14: 4	32.09	17.9	14:32	5.77	19.7	14:14	30.79	19.6	14:16	32.45	19.5
14:26	33.23	18.6	14:54	31.95	19.6	14:35	31.90	19.6	14:38	33.13	19.5
14:47	34.37	18.3	15:15	33.12	19.3	14:57	31.95	19.6	15: 0	33.28	19.5
15: 9	1.66	18.7	15:37	33.00	19.3	15:18	32.64	19.6	15:21	33.92	19.6
15:31	38.34	18.7	15:58	34.53	19.5	15:40	32.52	19.6	15:42	34.19	19.7
15:52	37.47	18.7	16:20	34.90	19.5	16: 1	33.66	19.9	16: 4	34.77	19.6
16:14	36.28	18.7	16:41	35.83	19.6	16:23	34.55	19.9	16:25	36.00	19.7
16:35	37.88	18.9	17: 3	35.93	19.6	16:44	36.19	19.9	16:47	36.45	20.0
16:57	1.05	20.3	17:25	35.66	19.6	17: 6	36.02	19.9	17: 8	35.89	19.9
17:18	38.32	19.2	17:46	35.22	19.6	17:27	35.83	20.0	17:30	36.89	20.0
17:40	40.19	19.1	18: 8	34.50	19.6	17:49	35.61	19.8	17:51	37.61	20.0
18: 1	40.21	19.0	18:29	4.68	19.9	18:10	35.64	20.0	18:13	37.98	19.9
18:23	40.24	19.0	18:51	35.31	19.9	18:32	35.72	19.9	18:34	38.05	20.0
18:44	39.99	19.3	19:12	35.76	19.6	18:53	35.90	20.4	18:56	38.12	20.0
19: 6	39.09	19.2	19:34	36.79	19.6	19:15	36.49	20.1	19:17	37.88	20.0
19:27	22.46	19.3	19:55	36.21	19.9	19:37	35.74	20.2	19:39	38.88	20.0
19:49	38.44	19.4	20:17	36.78	19.6	19:58	35.22	20.1	20: 1	1.46	21.6
20:10	39.43	19.4	20:38	37.76	19.6	20:20	36.16	20.1	20:22	39.77	20.6
20:32	38.61	19.4	21: 0	36.71	19.9	20:41	35.33	19.9	20:44	39.24	20.1
20:53	40.23	19.2	21:21	36.74	19.6	21: 3	33.15	19.9	21: 5	39.86	20.1
21:15	40.31	19.2	21:43	36.19	19.6	21:25	34.66	19.9	21:27	39.09	20.0
21:36	40.52	19.2	22: 4	37.90	19.9	21:46	35.31	19.9	21:48	38.93	19.9
21:58	30.43	19.3	22:26	36.22	19.9	22: 7	35.34	19.9	22:10	38.83	19.6
22:19	40.48	19.2	22:47	37.49	19.6	22:29	34.84	20.1	22:31	39.03	20.2
22:41	0.86	21.0	23: 9	39.25	19.6	22:50	36.82	20.1	22:53	40.50	20.0
23: 3	40.89	19.2	23:31	38.47	19.6	23:12	36.26	19.9	23:15	39.31	20.0
23:25	20.83	19.4	23:52	39.25	19.6	23:33	35.49	20.0	23:36	39.21	19.9
23:46	1.86	19.6	0:14	-0.39	20.6	23:55	35.68	19.9	23:58	39.81	19.9

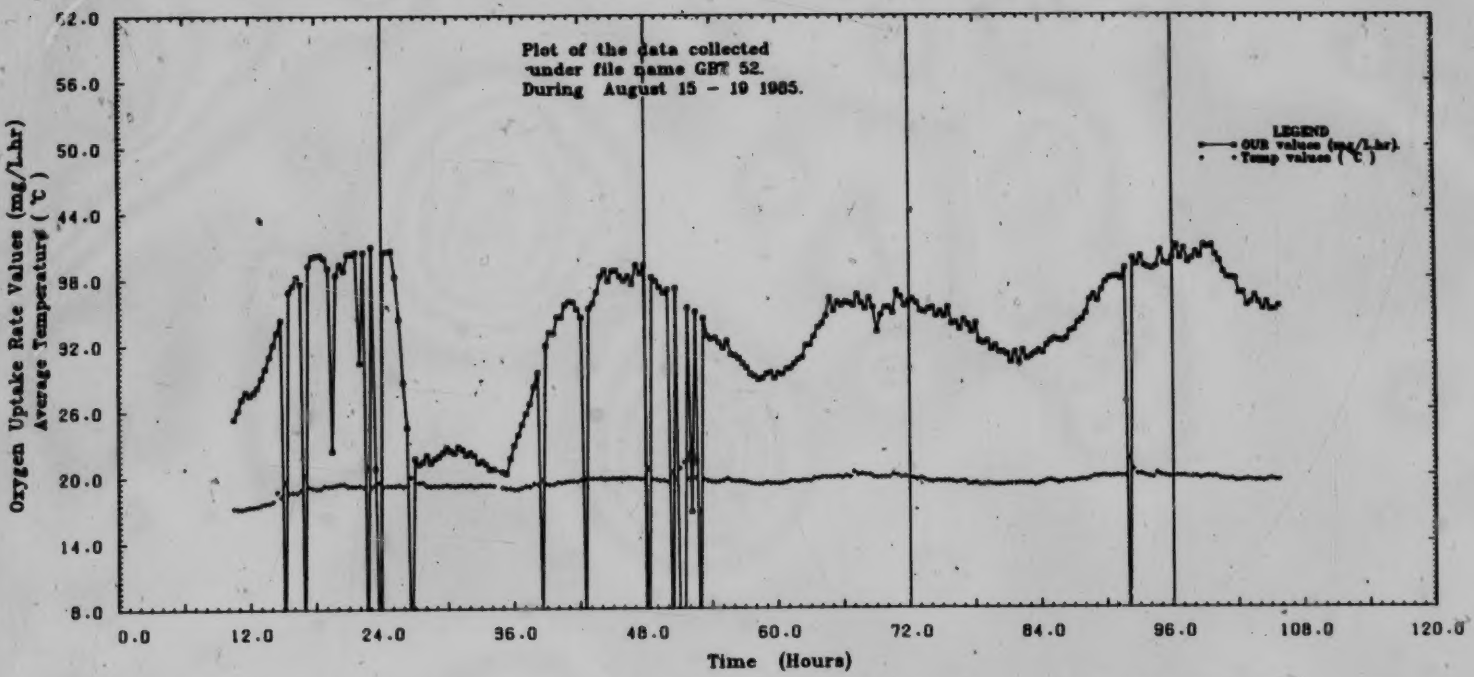
These data were collected under file SBT#52

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 15-19 / 8 / 1985)

DAY 5 19 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0:19	40.96	20.0
0:41	39.78	19.9
1: 2	40.86	20.0
1:25	39.41	19.8
1:45	39.74	19.9
2: 7	40.32	19.9
2:28	39.88	19.8
2:50	40.57	19.9
3:11	40.78	19.9
3:33	40.82	19.9
3:54	40.04	19.9
4:16	38.50	19.7
4:38	38.50	19.7
5: 0	38.01	19.8
5:21	37.84	19.7
5:42	37.88	19.5
6: 4	36.57	19.5
6:25	36.61	19.6
6:47	35.48	19.7
7: 8	35.72	19.6
7:30	36.32	19.5
7:51	35.70	19.5
8:13	35.15	19.5
8:34	35.72	19.6
8:56	35.02	19.7
9:18	35.08	19.6
9:39	35.40	19.5

These data were collected under file GBT#52



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 11-14 / 8 / 1985)

DAY 1 11 8 85			DAY 2 12 8 85			DAY 3 13 8 85			DAY 4 14 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:11	42.35	18.4	0:17	46.65	19.4	0:20	44.61	19.6
			0:32	38.66	18.3	0:38	45.13	19.2	0:41	45.13	19.6
			0:54	37.31	18.4	1: 0	44.90	19.3	1: 3	45.61	19.9
			1:16	37.07	18.3	1:21	45.66	19.2	1:25	44.82	19.9
			1:37	36.11	18.1	1:43	44.99	19.3	1:46	44.66	19.9
			1:58	38.81	18.4	2: 4	44.92	19.6	2: 7	43.86	19.6
			2:20	37.26	18.1	2:26	43.74	19.3	2:29	43.61	19.6
			2:41	37.86	18.1	2:47	43.09	19.2	2:51	43.64	20.0
			3: 3	37.14	18.1	3: 9	44.22	19.6	3:12	43.01	19.9
			3:25	36.03	17.9	3:30	42.99	19.5	3:34	43.57	19.9
			3:46	35.25	18.0	3:52	44.69	19.6	3:55	42.49	19.6
			4: 7	35.44	18.0	4:14	43.10	19.3	4:17	41.58	19.6
			4:29	34.65	17.9	4:35	42.34	19.3	4:38	41.06	19.7
			4:51	34.87	18.1	4:57	42.55	19.2	5: 0	41.70	19.7
			5:12	33.06	17.9	5:18	41.61	19.3	5:21	43.64	19.6
			5:34	31.23	17.8	5:40	42.15	19.5	5:43	42.80	19.6
			5:55	28.53	17.7	6: 1	43.05	19.5	6: 4	40.79	19.6
			6:17	28.95	17.8	6:23	42.16	19.7	6:26	40.71	19.5
			6:38	27.94	17.8	6:44	40.59	19.3	6:48	38.95	19.6
			7: 0	27.99	17.9	7: 6	39.15	19.3	7: 9	38.80	19.6
			7:21	28.35	17.8	7:27	40.37	19.3	7:31	38.11	19.5
			7:43	28.85	17.8	7:50	39.42	19.2	7:52	37.64	19.5
			8: 4	29.88	17.8	8:11	39.41	19.2	8:14	37.88	19.5
			8:26	30.36	17.8	8:32	38.68	19.2	8:35	37.81	19.5
			8:47	32.18	17.8	8:54	38.43	19.2	10:54	37.89	19.3
			9: 9	31.05	17.8	9:15	38.28	19.3	11:16	36.76	19.1
			9:30	31.79	17.8	9:37	38.30	19.3	11:37	37.61	19.3
			9:52	31.89	17.8	9:58	37.74	19.2	12: 0	37.18	19.1
			10:38	33.21	17.8	10:20	37.81	19.0	12:20	37.51	19.2
10:54	37.89	19.3	11: 0	32.67	17.8	10:41	38.95	19.1	12:42	37.30	19.1
11:16	36.76	19.1	11:21	32.52	17.8	11: 3	37.11	19.0	13: 4	37.38	19.0
11:37	37.61	19.3	11:43	32.08	17.8	11:25	36.89	19.0	13:25	36.25	19.0
12: 0	37.18	19.1	12: 4	32.87	17.9	11:46	36.32	19.1	13:47	38.08	18.9
12:20	37.51	19.2	12:26	32.96	17.7	12: 8	37.03	19.1	14: 8	38.74	19.0
12:42	37.30	19.1	12:47	33.52	17.7	12:29	37.95	19.1	14:30	38.16	19.0
13: 4	37.38	19.0	13: 9	34.21	17.7	12:51	37.67	19.3	14:51	39.17	19.0
13:25	36.25	19.0	13:30	34.97	17.8	13:12	37.99	19.1	15:13	38.46	18.9
13:47	38.08	18.9	13:52	36.12	18.1	13:34	38.56	19.2	15:34	40.12	19.0
14: 8	38.74	19.0	14:13	37.61	18.1	13:55	38.45	19.3	15:56	41.63	19.0
14:30	38.16	19.0	14:35	38.36	18.2	14:17	39.04	19.2	16:17	42.94	19.0
14:51	39.17	19.0	14:56	38.37	18.2	14:38	38.84	19.3	16:39	43.08	19.0
15:13	38.46	18.9	15:18	36.78	18.4	15: 0	39.30	19.4	17: 0	45.22	18.9
15:34	40.12	19.0	15:39	38.81	18.4	15:21	40.00	19.5	17:22	44.35	19.0
15:56	41.63	19.0	16: 1	40.79	18.5	15:43	40.04	19.5	17:43	45.16	19.2
16:17	42.94	19.0	16:23	39.52	18.5	16: 4	41.02	19.6	18: 5	45.73	19.5
16:39	43.08	19.0	16:44	41.31	18.6	16:26	40.76	19.6	16:28	53.47	19.1
17: 0	45.22	18.9	17: 6	40.06	18.7	16:48	42.25	19.8	16:51	43.42	19.6
17:22	44.35	19.0	17:27	41.68	18.7	17: 9	42.22	19.8	17:12	43.70	19.7
17:43	45.16	19.2	17:50	41.07	18.7	17:31	42.44	19.8	17:34	44.71	19.8
18: 5	42.85	18.8	18:10	43.12	19.0	17:52	45.04	19.6	17:55	45.86	20.1
18:26	42.61	19.1	18:32	44.65	19.2	18:14	44.41	19.6	18:17	45.31	19.6
18:48	41.82	19.0	18:53	43.42	19.0	18:35	45.67	19.9	18:38	44.00	19.8
19: 9	41.46	19.0	19:15	43.41	18.9	18:57	44.32	19.8	19: 0	42.66	19.6
19:31	41.41	18.9	19:36	44.05	19.0	19:18	45.83	19.5	19:22	44.22	19.9
19:52	41.00	18.9	19:58	40.16	19.0	19:40	46.06	19.8	19:43	43.32	19.6
20:14	40.54	19.0	20:20	36.84	19.3	20: 1	47.45	19.6	20: 5	41.83	19.8
20:36	40.20	19.0	20:41	35.89	19.3	20:23	45.73	19.7	20:26	42.00	19.6
20:57	40.36	18.8	21: 3	35.06	19.0	20:44	44.58	19.6	20:48	41.28	19.6
21:19	41.29	19.0	21:25	35.38	19.4	21: 6	44.25	19.8	21: 9	39.85	19.3
21:40	40.86	19.0	21:46	36.16	19.3	21:28	45.51	19.9	21:31	38.41	19.3
22: 2	40.44	18.8	22: 7	40.44	19.2	21:50	44.17	19.9	21:52	36.52	19.0
22:23	40.52	18.8	22:29	45.37	19.4	22:11	44.46	19.6	22:14	35.29	19.0
22:45	42.39	18.7	22:50	43.95	19.2	22:32	44.45	19.6	22:35	32.01	18.6
23: 6	44.83	18.7	23:12	44.32	19.2	22:54	44.83	19.8	22:57	29.45	18.8
23:28	43.61	18.3	23:33	45.09	19.5	23:15	45.66	19.6	23:18	27.35	18.7
23:50	43.76	18.3	23:55	45.06	19.3	23:37	45.87	19.9	23:40	26.45	18.6

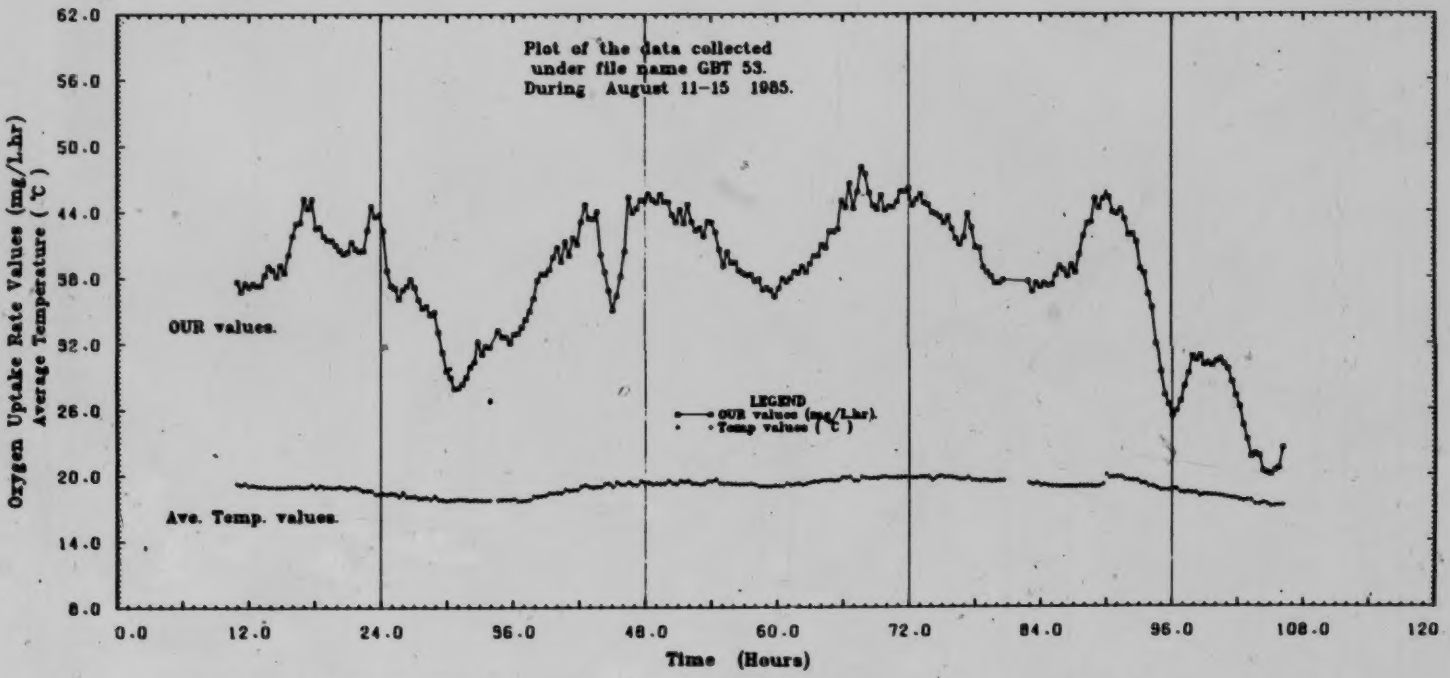
These data were collected under file SBT#53

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 14-14 / 8 / 1985)

DAY 5 14 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0: 1	25.44	18.8
0:23	25.89	18.7
0:45	26.74	18.4
1: 5	28.14	18.4
1:28	29.28	18.4
1:50	30.86	18.4
2:11	30.48	18.4
2:32	30.89	18.1
2:54	30.07	18.2
3:15	30.21	18.2
3:37	30.00	18.2
4: 0	30.38	18.2
4:20	30.57	18.1
4:42	30.13	18.0
5: 3	29.67	18.0
5:25	28.52	17.9
5:46	27.28	17.9
6: 8	26.27	17.8
6:29	24.57	17.8
6:51	23.26	17.8
7:12	21.88	17.7
7:34	21.86	17.4
7:56	21.74	17.3
8:17	20.39	17.5
8:38	20.22	17.4
9: 0	20.08	17.2
9:22	20.46	17.2
9:43	20.65	17.2
10: 5	22.50	17.3

These data were collected under file GBT#53



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

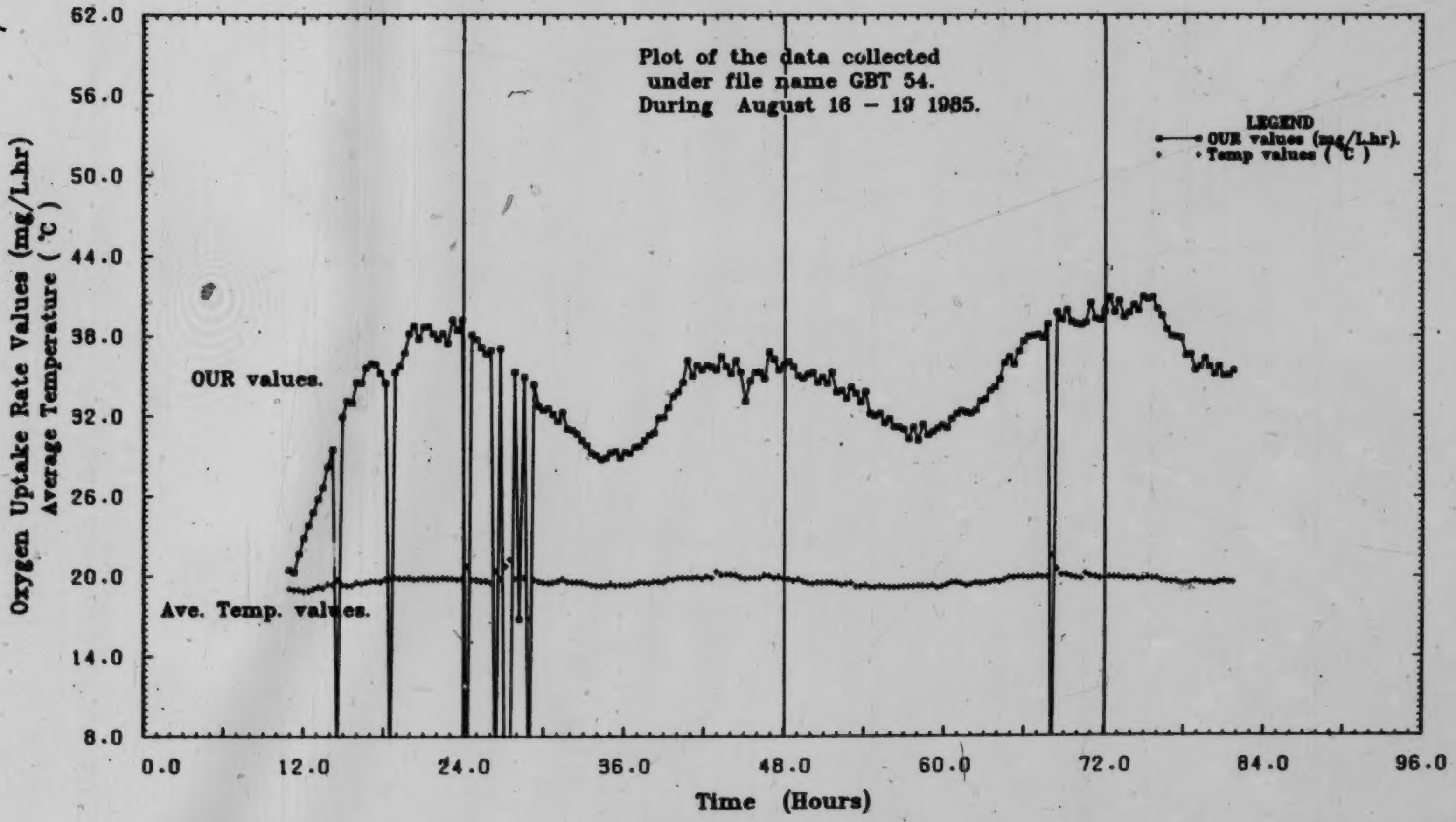
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 16-19 / 8 / 1985)

DAY 1 16 8 85			DAY 2 17 8 85			DAY 3 18 8 85			DAY 4 19 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:14	-0.38	20.6	0:18	36.10	19.6	0:19	40.96	20.0
			0:35	38.13	19.8	0:39	35.74	19.7	0:41	39.78	19.9
			0:57	37.75	19.7	1: 0	35.05	19.8	1: 2	40.86	20.0
			1:18	37.16	19.8	1:21	34.86	19.7	1:25	39.41	19.6
			1:40	36.69	19.7	1:43	35.16	19.5	1:45	39.74	19.9
			2: 1	36.97	19.5	2: 4	35.32	19.5	2: 7	40.32	19.9
			2:23	0.88	20.4	2:26	34.56	19.6	2:28	39.89	19.6
			2:44	37.06	19.6	2:47	34.95	19.5	2:50	40.57	19.9
			3: 6	1.86	20.6	3: 9	34.50	19.6	3:11	40.78	19.9
			3:27	1.03	21.3	3:30	35.32	19.6	3:33	40.92	19.9
			3:50	35.32	19.6	3:52	33.85	19.5	3:54	40.04	19.9
			4:10	16.80	20.0	4:13	33.95	19.4	4:16	39.50	19.7
			4:32	34.95	19.9	4:35	33.35	19.5	4:38	38.50	19.7
			4:54	0.87	19.6	4:56	34.19	19.5	5: 0	38.01	19.8
			5:15	34.40	19.6	5:18	33.74	19.2	5:21	37.94	19.7
			5:37	32.77	19.6	5:39	33.09	19.3	5:42	37.86	19.5
			5:58	32.47	19.5	6: 1	33.87	19.4	6: 4	36.57	19.5
			6:20	32.50	19.5	6:22	32.22	19.2	6:25	36.61	19.9
			6:41	32.15	19.5	6:44	32.03	19.2	6:47	35.45	19.7
			7: 3	31.85	19.8	7: 5	32.24	19.3	7: 8	35.72	19.6
			7:25	32.31	19.6	7:27	31.51	19.2	7:30	36.32	19.5
			7:46	31.06	19.6	7:48	31.82	19.2	7:51	35.70	19.5
			8: 8	30.97	19.6	8:10	31.23	19.2	8:13	35.15	19.5
			8:29	30.89	19.6	8:31	31.23	19.2	8:34	35.72	19.6
			8:51	30.23	19.5	8:53	31.02	19.3	8:56	35.02	19.7
			9:12	29.85	19.6	9:14	30.31	19.3	9:18	35.06	19.6
			9:34	29.28	[illegible]	9:36	31.22	19.3	9:39	35.40	19.6
			9:55	29.11	19.3	9:58	30.22	19.3			
			10:17	28.79	19.3	10:19	31.39	19.3			
10:58	20.46	19.1	10:38	28.90	19.3	10:41	30.82	19.3			
11:19	20.31	19.0	11: 0	29.28	19.4	11: 2	30.86	19.3			
11:40	21.66	19.0	11:21	29.40	19.3	11:25	31.11	19.2			
12: 1	22.88	18.9	11:43	28.92	19.4	11:45	31.38	19.3			
12:23	23.82	18.9	12: 4	29.34	19.3	12: 7	31.15	19.4			
12:44	24.79	19.0	12:26	29.27	19.4	12:28	31.61	19.6			
13: 6	25.60	19.2	12:48	29.73	19.4	12:50	32.21	19.6			
13:27	26.66	19.1	13: 9	29.60	19.6	13:11	32.43	19.5			
13:50	28.22	19.4	13:31	30.22	19.6	13:33	32.32	19.3			
14:11	29.48	19.4	13:52	30.61	19.5	13:54	32.24	19.4			
14:32	5.77	19.7	14:14	30.79	19.6	14:16	32.46	19.5			
14:54	31.95	19.4	14:35	31.80	19.6	14:38	33.13	19.5			
15:16	33.12	19.3	14:57	31.95	19.6	15: 0	33.26	19.5			
15:37	33.00	19.3	15:18	32.68	19.8	15:21	33.92	19.6			
15:58	34.53	19.5	15:40	33.52	19.6	15:42	34.19	19.7			
16:20	34.50	19.5	16: 1	33.86	19.9	16: 4	34.77	19.8			
16:41	35.63	19.6	16:23	34.55	19.9	16:25	36.00	19.7			
17: 3	35.93	19.6	16:44	36.19	19.9	16:47	36.45	20.0			
17:25	35.88	19.8	17: 6	35.02	19.8	17: 8	35.89	19.9			
17:46	35.22	19.6	17:27	35.63	20.0	17:30	36.89	20.0			
18: 8	34.50	19.6	17:50	35.61	19.8	17:51	37.61	20.0			
18:29	4.56	19.9	18:10	35.84	20.0	18:13	37.98	19.9			
18:51	36.31	19.9	18:32	35.72	19.9	18:34	38.05	20.0			
19:12	35.76	19.6	18:53	35.50	20.4	18:56	38.12	20.0			
19:34	36.79	19.6	19:15	36.49	20.1	19:17	37.89	20.0			
19:55	36.21	19.9	19:37	35.74	20.2	19:39	38.88	20.0			
20:17	36.76	19.6	19:58	35.22	20.1	20: 1	1.46	21.6			
20:38	37.74	19.6	20:20	36.18	20.1	20:22	39.77	20.6			
21: 0	36.71	19.9	20:41	35.33	19.9	20:44	39.24	20.1			
21:21	36.74	19.6	21: 3	33.15	19.9	21: 5	39.96	20.1			
21:43	36.19	19.6	21:25	34.66	19.8	21:27	39.09	20.0			
22: 4	37.60	19.6	21:46	35.31	19.5	21:48	38.93	19.9			
22:26	36.22	19.9	22: 7	35.34	19.9	22:10	38.63	19.8			
22:47	37.49	19.6	22:29	34.84	20.1	22:31	39.03	20.2			
23: 9	39.28	19.6	22:50	36.82	20.1	22:53	40.50	20.0			
23:31	36.47	19.6	23:12	36.28	19.9	23:15	39.31	20.0			
23:52	39.26	19.6	23:33	35.49	20.0	23:36	39.21	19.9			

These data were collected under file SBT#54



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 19-22 / 8 / 1985)

DAY 1			DAY 2			DAY 3			DAY 4		
19 8 85			20 8 85			21 8 85			22 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:16	47.70	20.2	0:18	43.43	19.1	0: 0	44.41	18.7
			0:37	47.05	20.2	0:40	43.98	19.3	0:21	44.55	18.7
			1: 0	47.49	20.1	1: 1	43.56	19.3	0:42	43.96	18.8
			1:20	46.38	20.2	1:23	43.33	19.3	1: 4	43.39	18.8
			1:42	46.76	20.1	1:45	42.12	19.2	1:25	45.01	19.0
			2: 3	46.09	20.1	2: 6	42.55	19.3	1:47	43.48	19.1
			2:25	47.05	20.1	2:28	41.53	19.3	2: 9	43.68	18.9
			2:46	46.80	20.1	2:50	41.92	19.3	2:30	44.39	18.9
			3: 8	45.42	20.1	3:11	40.72	19.0	2:52	43.63	18.8
			3:29	45.29	20.3	3:32	40.81	19.0	3:13	43.51	19.1
			3:51	44.66	20.2	3:54	39.90	19.3	3:35	42.66	18.9
			4:12	44.73	20.1	4:15	39.83	19.0	3:56	42.09	18.8
			4:34	47.79	20.2	4:36	38.69	19.0	4:18	41.68	18.8
			4:55	47.98	20.1	4:58	38.59	19.0	4:39	41.20	18.7
			5:17	47.28	19.8	5:19	38.11	19.3	5: 1	41.14	18.7
			5:38	47.29	19.8	5:41	37.01	19.0	5:22	41.31	18.7
			6: 0	37.46	19.7	6: 3	37.29	19.0	5:44	40.46	18.7
			6:21	43.51	19.4	6:25	37.65	19.0	6: 5	39.71	18.7
			6:43	39.46	19.2	6:46	36.24	19.1	6:27	39.43	18.7
			7: 5	36.06	18.9	7: 7	36.14	19.0	6:48	39.18	18.7
			7:26	32.88	19.0	7:28	35.92	19.0	7:10	38.85	18.8
			7:48	31.89	19.0	7:50	35.85	19.0	7:32	38.72	18.8
			8: 9	29.86	18.8	8:12	35.62	18.9	7:53	39.19	18.9
			8:31	27.09	18.8	8:33	34.88	18.9	8:15	38.39	18.9
			8:52	24.79	18.7	8:55	34.75	18.9	8:36	37.88	19.0
			9:14	24.12	18.8	9:16	35.24	19.0	8:58	37.98	18.7
			9:35	22.35	18.8	9:38	34.72	18.9	9:19	38.50	18.9
			9:57	22.58	18.7	10: 0	35.02	18.9	9:41	38.37	19.0
			10:18	24.03	18.8	10:21	35.35	18.7	10: 2	38.67	18.7
10:37	37.94	19.9	10:40	25.07	18.5	10:43	35.79	18.8	10:25	41.88	20.1
11: 0	37.10	19.4	11: 1	26.11	18.7	11: 4	36.01	18.7	10:45	39.54	19.0
11:20	37.81	19.3	11:23	27.86	18.3	11:26	36.81	18.8	11: 7	39.80	19.0
11:42	37.87	19.4	11:45	30.51	18.4	11:47	36.07	18.8	11:28	39.64	19.0
12: 3	39.23	19.5	12: 6	32.38	18.4	12: 9	37.86	18.7	11:50	40.42	19.0
12:25	39.20	19.5	12:28	32.96	18.4	12:30	37.98	18.7	12:11	41.88	19.3
12:46	41.84	19.7	12:50	34.45	18.5	12:52	37.17	18.4	12:33	41.57	19.3
13: 8	41.15	19.8	13:11	34.00	18.2	13:13	36.26	18.4	12:54	42.64	19.2
13:29	42.92	19.7	13:32	33.58	18.4	13:35	35.94	18.4	13:16	43.28	19.4
13:51	46.05	19.8	13:54	34.09	18.4	13:56	35.74	18.4	13:37	43.12	19.4
14:12	47.02	19.8	14:15	33.86	18.4	14:18	34.42	18.3	14: 0	44.75	19.3
14:34	46.91	20.0	14:37	33.85	18.4	14:40	34.51	18.3	14:20	45.74	19.5
14:55	46.89	20.2	14:58	33.88	18.4	15: 1	34.65	18.4	14:42	46.97	19.5
15:17	0.22	20.6	15:20	34.23	18.4	15:23	36.22	18.4	15: 3	45.92	19.5
15:39	46.93	20.3	15:41	34.06	18.4	15:44	36.27	18.4	15:25	46.43	19.8
16: 0	0.48	21.4	16: 3	35.23	18.5	16: 6	36.38	18.5	15:46	46.47	20.1
16:23	47.47	20.4	16:25	35.55	18.8	16:27	38.34	18.4	16: 8	47.99	20.6
16:44	46.99	20.4	16:46	36.64	18.9	16:50	38.97	18.4	16:30	48.29	20.9
17: 6	46.86	20.4	17: 7	38.20	18.8	17:10	40.19	18.7	16:51	48.61	21.0
17:27	46.68	20.5	17:28	37.86	19.0	17:32	40.10	18.8	17:13	50.23	21.0
17:48	46.82	20.5	17:51	38.60	19.0	17:53	40.98	18.7	17:34	50.20	20.9
18:10	50.64	20.7	18:12	39.81	19.0	18:15	41.70	18.7	17:56	52.18	21.1
18:31	49.37	20.7	18:34	39.48	19.0	18:36	42.21	18.7	18:17	53.04	21.1
18:53	51.80	20.7	18:55	39.40	19.3	18:58	41.02	18.8	18:39	52.57	21.2
19:14	51.09	20.7	19:17	40.21	19.3	19:20	41.27	18.8	19: 0	52.86	21.1
19:36	49.19	20.5	19:38	40.39	19.2	19:41	41.05	18.7	19:22	53.32	21.2
19:57	49.42	20.4	20: 0	40.84	19.0	20: 3	41.05	18.7	19:43	54.14	21.2
20:19	47.97	20.4	20:21	42.32	19.2	20:25	41.56	18.7	20: 5	54.19	21.2
20:40	48.10	20.4	20:43	41.34	19.1	20:46	42.00	18.8	20:26	53.64	21.1
21: 2	50.28	20.5	21: 4	41.62	19.3	21: 7	42.09	18.7	20:48	56.19	21.0
21:23	48.85	20.7	21:26	40.90	19.1	21:29	41.84	18.8	21: 9	54.95	21.1
21:45	48.92	20.7	21:47	41.61	19.1	21:50	43.11	18.7	21:31	55.36	21.1
22: 6	48.68	20.6	22: 9	42.48	19.0	22:12	43.87	18.7	21:53	53.14	20.9
22:28	49.21	20.4	22:31	42.97	19.2	22:33	44.12	18.9	22:14	52.43	20.7
22:50	47.07	20.4	22:52	43.08	19.2	22:55	45.20	18.8	22:36	52.86	21.0
23:11	1.54	22.7	23:14	43.05	19.3	23:16	46.06	18.9	22:57	54.96	21.6
23:32	48.95	20.4	23:35	43.07	19.2	23:38	45.52	18.8	23:19	51.38	21.3
23:54	47.82	20.2	23:57	42.94	19.1	0: 0	44.41	18.7	23:40	50.24	21.2

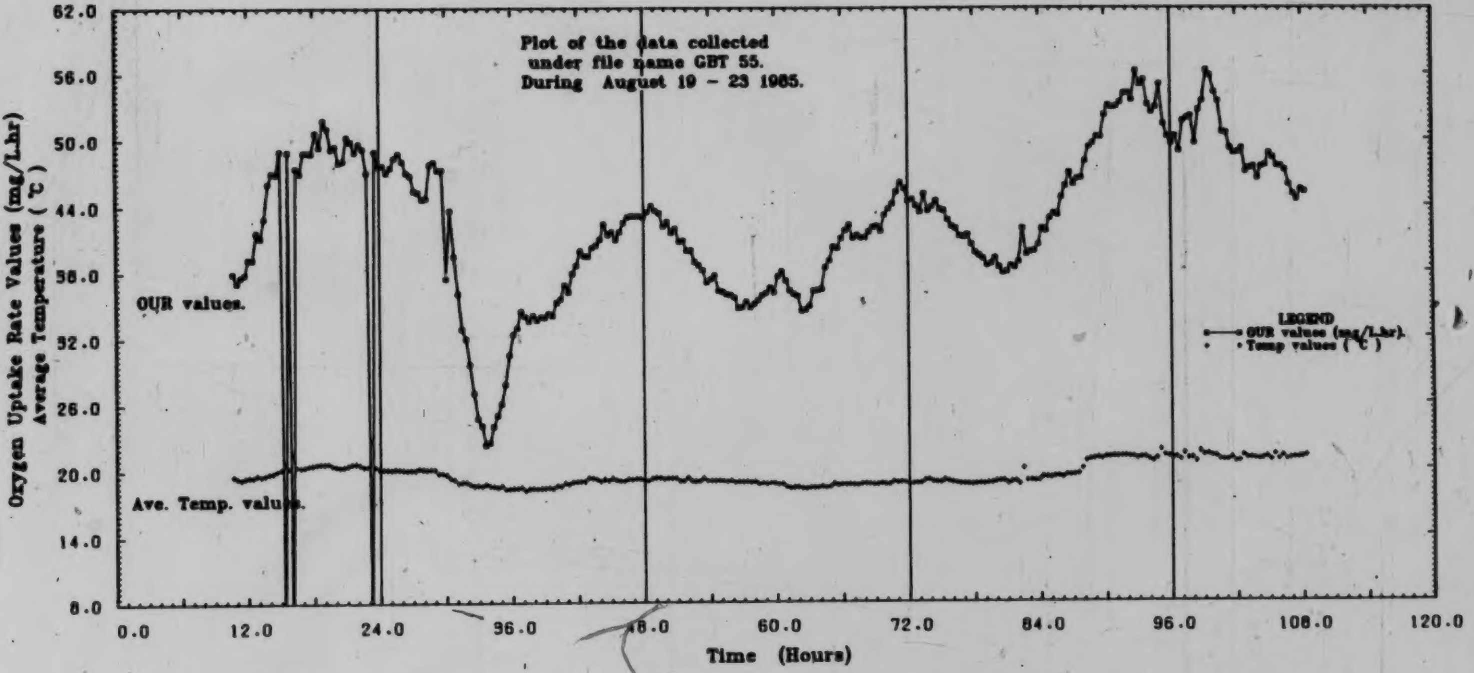
These data were collected under file SST#85

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 23-23 / 8 / 1985)

DAY 5 23 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0: 2	49.61	20.9
0:23	50.28	21.1
0:45	48.94	20.8
1: 6	51.66	21.4
1:28	51.92	21.0
1:50	52.10	21.0
2:11	49.85	20.7
2:33	52.65	21.6
2:54	53.46	21.3
3:16	55.22	21.3
3:37	55.77	21.2
4: 0	54.24	21.2
4:20	53.43	20.9
4:42	50.85	20.8
5: 3	50.56	20.8
5:25	49.16	21.0
5:46	48.74	20.7
6: 8	48.80	20.7
6:29	49.15	21.2
6:51	47.06	21.0
7:13	47.38	21.0
7:34	47.48	20.9
7:56	48.45	20.9
8:17	47.49	20.9
8:38	47.82	21.1
9: 1	48.70	20.8
9:22	48.30	21.3
9:44	47.58	20.9
10: 5	47.53	21.2
10:27	47.19	20.9
10:48	45.86	20.9
11:10	45.01	21.0
11:31	44.53	21.0
11:53	45.41	21.1
12:14	45.21	21.2

These data were collected under file GBT#85



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

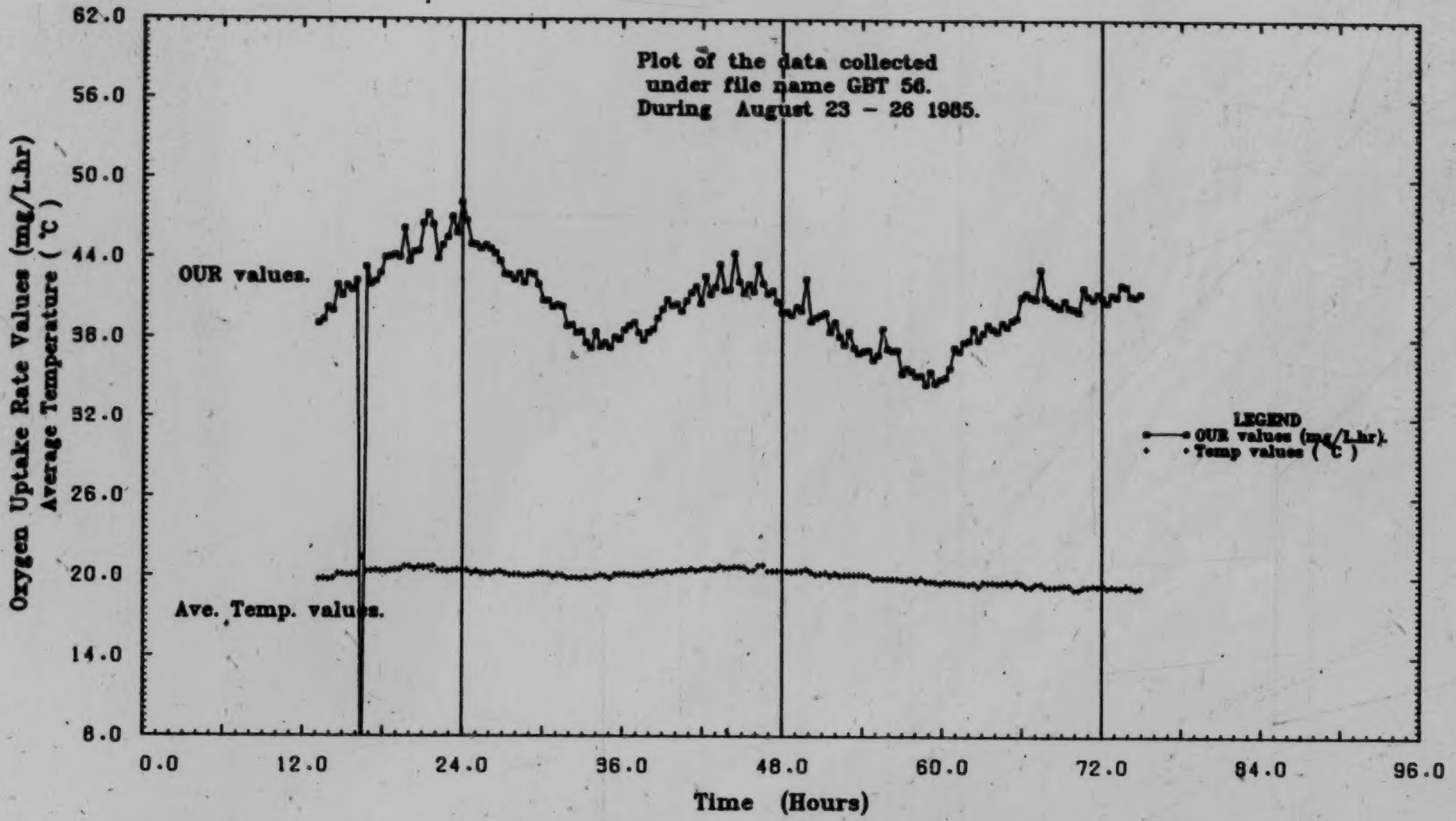
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 23-26 / 8 / 1985)

DAY 1 23 8 85			DAY 2 24 8 85			DAY 3 25 8 85			DAY 4 26 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/l	TEMP C
			0:17	46.76	20.5	0:20	39.95	20.4	0: 1	41.10	19.5
			0:39	45.02	20.3	0:41	39.71	20.4	0:23	40.70	19.2
			1: 0	44.95	20.4	1: 3	40.32	20.4	0:44	41.21	19.3
			1:22	44.66	20.2	1:25	40.06	20.4	1: 6	41.18	19.3
			1:43	44.82	20.2	1:46	42.60	20.6	1:27	42.06	19.2
			2: 5	44.85	20.3	2: 7	39.25	20.3	1:50	41.92	19.4
			2:26	44.30	20.3	2:29	39.50	20.1	2:10	41.24	19.3
			2:48	43.72	20.4	2:50	39.70	20.2	2:32	41.16	19.1
			3:10	42.76	20.3	3:12	39.89	20.3	2:53	41.40	19.2
			3:31	42.86	20.1	3:33	38.48	20.1			
			3:53	42.33	20.1	3:55	39.19	20.3			
			4:14	42.78	20.1	4:16	38.13	20.1			
			4:36	42.13	20.1	4:38	37.61	20.1			
			4:57	42.86	20.1	5: 0	38.48	20.1			
			5:19	42.75	20.1	5:21	37.28	20.2			
			5:40	41.99	20.2	5:42	38.86	20.2			
			6: 2	40.79	20.2	6: 4	37.02	20.1			
			6:23	40.74	20.2	6:26	37.06	20.1			
			6:45	40.30	20.0	6:47	36.35	19.8			
			7: 6	40.42	20.1	7: 9	36.71	19.9			
			7:28	40.31	20.1	7:30	36.88	19.8			
			7:50	38.88	19.9	7:52	37.20	19.9			
			8:11	38.96	19.9	8:13	37.08	19.8			
			8:32	38.37	19.9	8:35	37.09	19.8			
			8:54	38.45	19.8	8:56	36.33	19.8			
			9:15	37.83	20.0	9:18	35.73	19.8			
			9:37	37.21	19.8	9:39	35.61	19.9			
			9:58	38.43	20.0	10: 1	35.16	19.7			
			10:20	37.31	20.1	10:22	35.19	19.9			
			10:41	37.60	20.0	10:44	34.52	19.7			
			11: 3	37.24	19.8	11: 6	35.46	19.7			
			11:25	38.03	20.1	11:27	34.61	19.8			
			11:46	37.86	20.1	11:50	34.89	19.5			
			12: 8	38.57	20.2	12:10	35.02	19.6			
			12:29	38.89	20.1	12:32	35.74	19.6			
			12:51	39.12	20.2	12:53	37.28	19.6			
			13:12	38.35	20.1	13:15	37.03	19.6			
13: 9	39.07	19.8	13:34	37.60	20.2	13:36	37.66	19.5			
13:31	39.33	19.9	13:55	38.38	20.3	13:58	37.84	19.4			
13:52	40.25	19.8	14:17	38.63	20.1	14:19	36.77	19.6			
14:14	40.02	19.9	14:38	39.44	20.3	14:41	37.66	19.3			
14:36	41.90	20.2	15: 0	40.12	20.3	15: 2	38.40	19.6			
14:57	41.14	20.1	15:21	40.84	20.4	15:25	39.03	19.6			
15:19	41.90	20.1	15:43	40.42	20.3	15:46	38.71	19.6			
15:40	41.57	20.1	16: 4	40.51	20.5	16: 7	36.61	19.5			
16: 2	42.28	20.1	16:26	40.00	20.5	16:29	39.14	19.5			
16:23	1.20	21.4	16:47	40.76	20.4	16:50	38.86	19.6			
16:45	43.27	20.4	17: 9	41.39	20.6	17:12	39.35	19.6			
17: 6	42.00	20.4	17:30	41.83	20.4	17:33	39.93	19.7			
17:28	42.23	20.5	17:52	40.57	20.5	17:55	41.11	19.6			
17:50	42.61	20.4	18:13	42.56	20.6	18:16	41.30	19.3			
18:11	43.99	20.3	18:35	41.26	20.6	18:38	41.11	19.2			
18:32	44.05	20.4	18:56	41.79	20.5	19: 0	40.89	19.5			
18:54	44.19	20.5	19:18	43.52	20.6	19:21	43.21	19.5			
19:15	44.01	20.5	19:39	41.55	20.6	19:42	41.06	19.3			
19:37	45.17	20.6	20: 1	41.63	20.6	20: 4	40.61	19.3			
20: 0	43.66	20.7	20:23	44.34	20.6	20:26	40.52	19.3			
20:20	44.42	20.5	20:44	42.23	20.7	20:47	40.34	19.3			
20:42	44.50	20.7	21: 6	41.37	20.7	21: 9	40.88	19.4			
21: 3	46.54	20.6	21:27	41.99	20.5	21:30	40.33	19.4			
21:25	47.29	20.7	21:50	41.49	20.5	21:52	40.23	19.1			
21:46	46.46	20.6	22:10	43.46	20.6	22:13	40.03	19.1			
22: 8	43.91	20.4	22:32	42.08	20.9	22:35	41.82	19.3			
22:29	44.92	20.4	22:53	41.32	20.4	22:56	41.21	19.3			
22:51	45.51	20.4	23:15	41.54	20.4	23:18	40.96	19.4			
23:13	47.04	20.5	23:36	40.70	20.4	23:39	41.35	19.3			
23:34	45.86	20.5	23:58	39.90	20.5	0: 1	41.10	19.5			
23:56	46.14	20.4	0:20	39.95	20.4	0:23	40.70	19.2			

These data were collected under file GBT#56



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 26-29 / 8 / 1985)

DAY 1			DAY 2			DAY 3			DAY 4		
26 8 85			27 8 85			28 8 85			29 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:20	35.44	19.6	0: 1	52.04	19.7	0: 4	49.81	19.8
			0:41	35.37	19.6	0:22	51.31	19.7	0:26	49.99	19.8
			1: 3	35.38	19.6	0:44	52.50	19.6	0:47	50.01	19.8
			1:25	35.08	19.7	1: 5	51.53	19.6	1: 8	49.51	19.8
			1:46	35.16	19.6	1:27	50.85	19.6	1:30	50.47	19.8
			2: 7	34.13	19.6	1:50	51.40	19.6	1:51	49.77	19.9
			2:29	33.36	19.6	2:10	49.28	19.7	2:13	48.88	19.8
			2:50	32.01	19.5	2:32	49.03	19.7	2:34	49.21	19.8
			3:12	31.84	19.7	2:53	46.69	19.6	2:56	49.12	19.7
			3:33	32.06	19.5	3:15	46.38	19.6	3:17	47.85	19.8
			3:55	32.09	19.6	3:36	48.01	19.7	3:39	48.43	19.8
			4:16	32.52	19.5	3:58	46.50	19.6	4: 0	48.45	19.8
			4:38	32.08	19.7	4:19	45.96	19.6	4:22	46.48	19.8
			5: 0	31.66	19.7	4:41	46.40	19.6	4:44	45.71	19.8
			5:21	32.56	19.6	5: 2	45.48	19.6	5: 5	46.27	19.7
			5:43	33.10	19.6	5:25	44.16	19.6	5:27	45.46	19.7
			6: 4	33.23	19.5	5:46	44.53	19.7	5:48	44.78	19.7
			6:26	33.85	19.5	6: 7	44.04	19.7	6:10	43.76	19.8
			6:47	34.47	19.6	6:29	43.65	19.6	6:31	43.48	19.8
			7: 9	34.89	19.5	6:50	43.36	19.6	6:53	43.69	19.7
			7:30	35.35	19.5	7:12	43.24	19.5	7:14	42.75	19.7
			7:52	35.32	19.5	7:33	42.24	19.5	7:36	42.50	19.8
			8:13	35.58	19.6	7:55	41.54	19.5	7:57	42.11	19.7
			8:35	36.11	19.6	8:16	41.58	19.5	8:19	42.71	19.8
			8:56	36.13	19.5	8:38	41.91	19.6	8:40	42.52	19.5
			9:18	35.46	19.5	9: 0	40.83	19.5	9: 2	41.78	19.5
			9:39	35.07	19.6	9:21	40.95	19.6	9:25	41.24	19.8
			10: 1	35.57	19.5	9:43	41.32	19.6	9:46	41.65	19.6
10:41	39.15	18.7	10:22	35.53	19.3	10: 4	40.36	19.5	10: 7	43.15	19.8
11: 3	39.44	18.8	10:44	35.61	19.2	10:26	40.53	19.3	10:28	45.60	20.0
11:25	38.87	18.7	11: 5	36.32	19.3	10:47	41.53	19.4	10:50	43.40	19.6
11:46	39.03	18.7	11:27	36.86	19.2	11: 9	41.21	19.3	11:11	42.76	19.6
12: 7	39.56	18.8	11:50	36.29	19.3	11:30	41.56	19.3	11:33	43.43	19.8
12:29	40.85	18.7	12:10	37.95	19.3	11:52	42.13	19.3	11:54	43.19	19.8
12:51	42.47	18.7	12:32	38.80	19.3	12:13	42.99	19.3	12:16	43.67	19.8
13:12	53.24	18.8	12:53	39.19	19.3	12:35	42.87	19.3	12:37	44.46	19.8
13:34	42.64	18.8	13:15	40.74	19.4	12:57	44.11	19.6	13: 0	44.22	19.8
13:56	42.95	19.0	13:36	41.86	19.4	13:18	44.98	19.5	13:20	44.84	19.9
14:17	41.57	19.1	13:58	41.85	19.3	13:40	44.85	19.5	13:42	45.51	19.9
14:38	38.48	19.0	14:19	42.85	19.4	14: 1	45.60	19.6	14: 4	46.44	19.9
15: 0	33.01	19.2	14:41	43.12	19.3	14:22	45.65	19.6	14:25	46.51	19.8
15:21	29.15	19.0	15: 2	43.15	19.6	14:44	46.51	19.7	14:47	47.26	19.8
15:43	28.85	19.4	15:25	43.74	19.6	15: 6	45.74	19.6	15: 8	47.00	20.1
16: 4	30.58	19.3	15:45	44.16	19.6	15:27	46.99	19.6	15:30	46.61	19.8
16:26	32.46	19.3	16: 7	44.00	19.6	15:50	48.09	19.8	15:51	47.47	20.1
16:47	34.26	19.5	16:28	44.40	19.6	16:10	48.26	19.7	16:13	47.42	20.1
17: 9	35.81	19.3	16:50	44.27	19.7	16:32	48.82	19.8	16:34	44.63	20.2
17:31	36.41	19.3	17:11	45.63	19.6	16:52	49.76	19.8	16:56	43.79	20.1
17:52	36.89	19.4	17:33	46.28	19.7	17:15	50.07	19.8	17:17	44.85	20.1
18:14	37.72	19.5	17:55	47.36	19.6	17:36	49.81	19.9	17:39	46.25	20.1
18:36	38.78	19.5	18:16	48.81	19.7	17:58	50.01	19.9	18: 0	47.77	20.2
18:57	40.32	19.6	18:38	48.62	19.6	18:19	49.83	19.9	18:22	50.02	20.4
19:18	41.65	19.7	19: 0	50.32	19.6	18:41	48.79	19.9	18:43	49.01	20.2
19:40	41.10	19.6	19:21	50.28	19.6	19: 2	48.66	19.9	19: 5	49.73	20.4
20:23	38.36	19.6	19:42	49.96	19.6	19:25	49.26	19.8	19:27	49.00	20.4
20:44	34.83	19.6	20: 4	50.31	19.6	19:46	49.96	19.9	19:48	50.28	20.5
21: 6	31.32	19.5	20:25	50.77	19.6	20: 7	49.26	20.0	20:10	50.40	20.5
21:27	28.05	19.6	20:47	49.28	19.6	20:28	50.20	19.9	20:31	51.70	20.4
21:50	27.75	19.6	21: 8	48.52	19.6	20:50	49.40	19.9	20:53	51.12	20.5
22:11	28.37	19.5	21:30	48.50	19.6	21:12	48.38	19.9	21:14	51.37	20.3
22:32	30.21	19.6	21:52	48.08	19.7	21:33	49.30	19.9	21:36	50.23	20.2
22:54	31.89	19.6	22:13	47.62	19.7	21:55	50.97	19.8	21:57	51.65	20.5
23:15	33.04	19.7	22:35	48.11	19.6	22:16	50.89	19.8	22:18	51.08	20.2
23:37	33.75	19.7	22:56	49.43	19.6	22:38	50.43	19.8	22:40	51.00	20.2
23:58	34.84	19.7	23:18	50.96	19.6	23: 0	49.70	19.9	23: 2	52.20	20.3

These data were collected under file OBT#87

Continuation from the last page.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 30-30 / 8 / 1985)

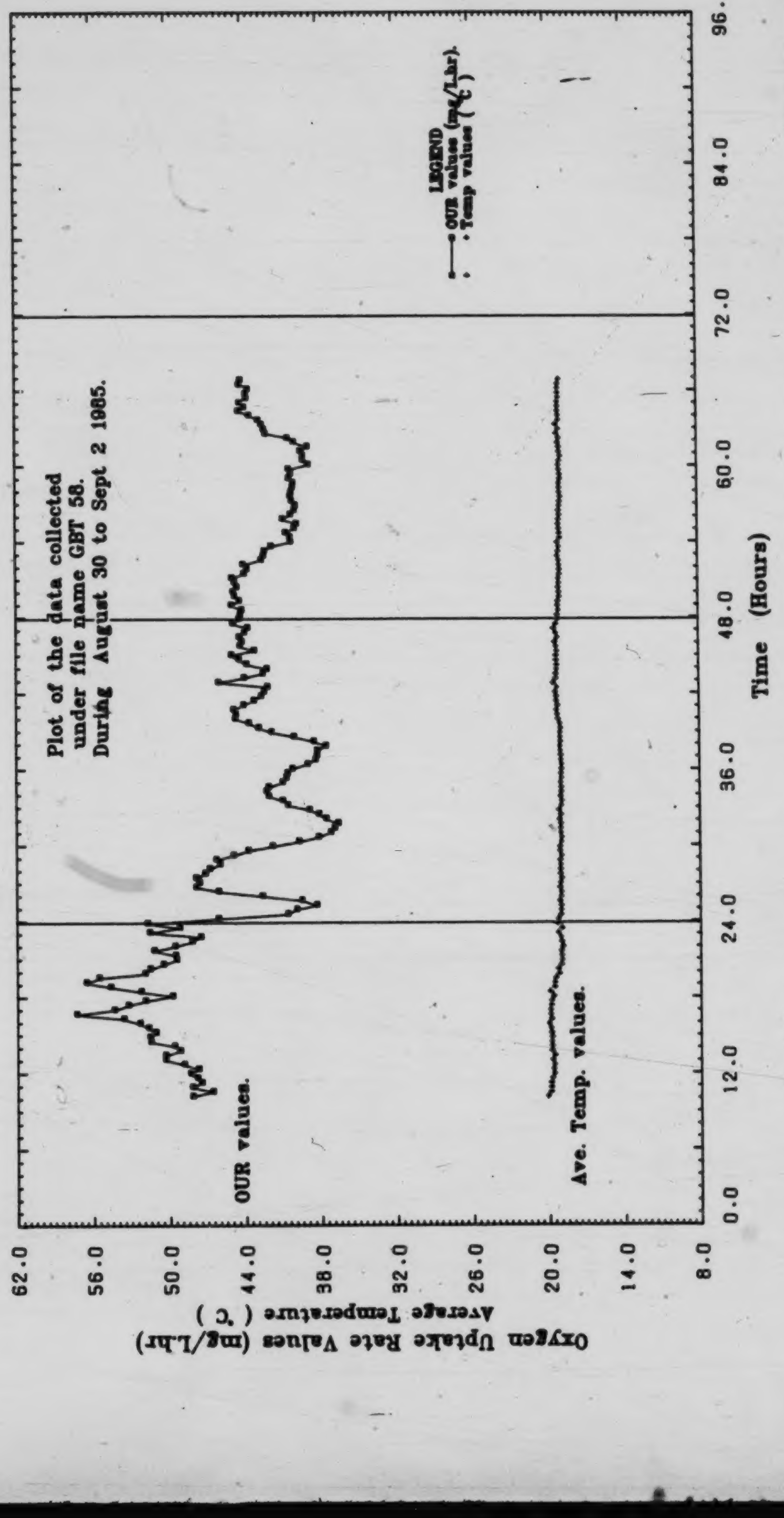
DAY 5 30 8 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C
0: 7	51.71	20.3
0:28	50.87	20.1
0:50	49.62	20.3
1:11	50.17	20.2
1:33	50.41	20.1
1:54	52.47	20.1
2:16	54.20	20.2
2:38	52.18	20.1
3: 0	50.61	20.3
3:21	49.82	20.1
3:42	48.27	20.1
4: 4	48.44	20.1
4:25	48.03	20.2
4:47	47.88	20.1
5: 8	48.35	20.1
5:30	46.11	20.0
5:52	45.81	19.9
6:13	45.62	19.8
6:35	44.84	20.0
6:56	45.17	19.9
7:18	44.59	19.9
7:39	44.73	19.8
8: 1	44.48	19.9
8:22	44.57	19.9
8:44	44.01	19.9
9: 5	44.07	19.8
9:27	44.18	19.8

These data were collected under file BBT#57

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of August 30 to Sept 1 1985)

DAY 1			DAY 2			DAY 3		
30 8 85			31 8 85			1 9 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:16	48.12	19.3	0:16	44.28	19.2
			0:37	40.83	19.0	0:40	44.14	19.1
			1: 0	39.84	19.0	1: 2	44.86	19.1
			1:20	38.34	19.0	1:23	44.33	19.1
			1:42	39.51	19.1	1:45	44.71	19.0
			2: 3	42.85	19.0	2: 6	44.62	19.0
			2:25	46.11	19.0	2:28	44.52	19.1
			2:46	47.86	19.1	2:50	44.71	19.1
			3: 8	47.61	19.0	3:11	44.81	19.1
			3:30	47.87	19.0	3:32	43.86	19.0
			3:51	47.15	19.1	3:54	43.71	19.0
			4:13	46.86	19.0	4:15	44.01	19.0
			4:34	45.97	19.1	4:37	42.58	19.1
			4:56	46.26	19.1	4:58	42.40	19.1
			5:17	44.90	19.0	5:20	42.33	19.1
			5:39	43.74	19.1	5:42	41.80	19.1
			6: 0	41.82	19.1	6: 3	40.24	19.1
			6:22	39.72	19.0	6:25	40.29	19.0
			6:43	38.19	19.0	6:46	40.64	19.0
			7: 5	37.22	19.0	7: 8	39.95	19.0
			7:26	38.82	19.0	7:29	39.76	19.1
			7:48	38.52	19.0	7:51	40.87	19.0
			8: 9	37.57	19.1	8:13	40.22	19.0
			8:31	38.15	19.0	8:34	39.86	19.0
			8:52	38.89	19.1	8:56	39.88	19.0
			9:14	40.55	19.0	9:17	40.15	18.9
			9:36	41.00	18.9	9:39	40.24	18.9
			9:57	42.11	19.0	10: 0	40.17	19.0
			10:19	42.30	19.0	10:22	40.07	19.0
10:16	46.21	20.1	10:40	42.11	19.0	10:43	40.02	19.0
10:37	46.84	19.9	11: 2	40.99	19.0	11: 5	40.36	18.9
11: 0	48.24	19.9	11:23	40.88	19.0	11:26	40.21	18.9
11:20	47.53	19.9	11:45	40.80	19.0	11:48	40.37	19.0
11:42	47.85	19.8	12: 6	40.22	18.9	12:10	38.61	19.0
12: 3	48.40	19.8	12:26	39.01	18.9	12:31	39.26	18.9
12:25	47.75	19.7	12:50	38.39	19.0	12:53	39.24	18.9
12:46	48.90	19.8	13:11	38.27	19.0	13:14	39.44	19.0
13: 8	50.36	19.7	13:32	38.25	19.1	13:36	38.88	19.0
13:30	50.37	19.8	13:54	37.57	19.1	13:57	39.97	19.1
13:51	49.21	19.8	14:15	38.52	19.0	14:19	40.46	19.0
14:13	49.67	19.8	14:37	40.98	19.0	14:40	43.30	19.2
14:34	51.52	19.8	15: 0	41.86	19.1	15: 2	42.34	19.0
14:56	51.56	19.8	15:20	42.87	19.0	15:25	42.50	19.2
15:17	51.11	19.8	15:42	43.64	19.1	15:45	42.78	19.0
15:39	51.88	19.9	16: 3	44.71	19.2	16: 7	43.48	19.0
16: 0	52.37	20.0	16:25	44.08	19.2	16:28	44.31	19.1
16:22	53.64	19.8	16:46	44.64	19.3	16:50	43.67	19.1
16:44	57.34	19.9	17: 8	44.06	19.2	17:11	44.23	19.1
17: 5	56.28	19.9	17:29	43.24	19.3	17:33	43.70	19.0
17:27	53.27	19.8	17:51	42.87	19.3	17:54	43.74	19.0
17:48	51.92	19.8	18:12	42.42	19.4	18:16	43.58	19.0
18:10	49.76	19.8	18:34	42.15	19.3	18:37	44.26	19.0
18:31	52.26	19.9	18:55	45.01	19.6	19: 0	44.15	18.9
18:53	54.86	19.8	19:17	43.99	19.3			
19:14	56.57	19.6	19:38	42.51	19.3			
19:36	55.56	19.5	20: 0	42.19	19.3			
19:57	51.83	19.2	20:21	43.79	19.2			
20:18	51.56	19.3	20:43	44.40	19.3			
20:40	50.48	19.0	21: 5	44.99	19.3			
21: 2	49.46	19.0	21:26	43.15	19.3			
21:23	49.53	19.0	21:48	44.31	19.3			
21:45	51.22	19.0	22: 9	44.16	19.4			
22: 6	49.57	18.9	22:31	44.38	19.2			
22:28	48.21	19.0	22:52	43.84	19.3			
22:50	47.54	19.1	23:14	43.89	19.5			
23:11	51.57	19.3	23:36	44.87	19.3			
23:33	49.20	19.0	23:57	44.37	19.2			
23:54	51.74	19.3	0:18	44.28	19.2			

These data were collected under file SBT#58



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

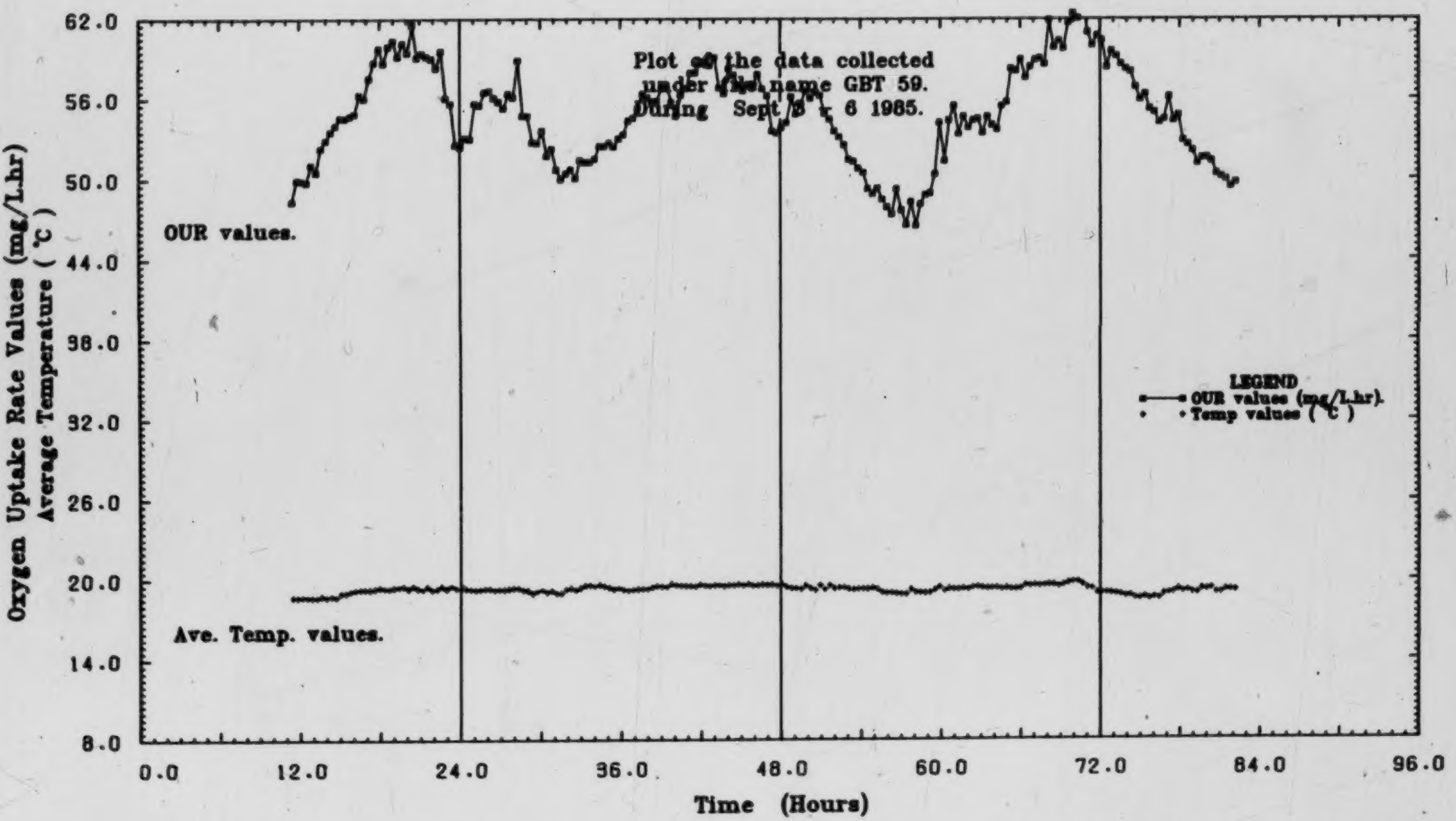
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 3- 6 / 9 / 1985)

DAY 1 3 9 85			DAY 2 4 9 85			DAY 3 5 9 85			DAY 4 6 9 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 0	52 42	19.3	0: 3	53.85	19.7	0: 8	60.39	19.0
			0:22	53.11	19.3	0:25	54.22	19.5	0:29	58.35	19.0
			0:43	53.02	19.3	0:47	56.13	19.4	0:50	59.57	19.0
			1: 5	55.67	19.3	1: 8	54.87	19.4	1:11	59.20	18.9
			1:26	55.55	19.3	1:30	55.62	19.3	1:32	58.61	18.9
			1:48	56.51	19.3	1:51	56.62	19.6	1:54	58.25	18.8
			2: 9	56.60	19.3	2:13	56.04	19.4	2:15	58.04	18.8
			2:31	55.09	19.3	2:34	56.51	19.2	2:37	56.64	18.8
			2:52	55.80	19.3	2:56	56.28	19.6	2:58	55.88	18.8
			3:14	55.33	19.3	3:17	54.92	19.3	3:20	56.34	18.7
			3:35	56.40	19.3	3:39	54.48	19.5	3:41	55.25	18.5
			3:57	56.14	19.4	4: 0	53.60	19.4	4: 3	55.00	18.7
			4:18	56.80	19.4	4:22	53.18	19.4	4:25	54.24	18.8
			4:40	54.77	19.3	4:44	52.55	19.4	4:46	54.47	18.9
			5: 1	54.73	19.2	5: 5	51.48	19.3	5: 8	56.15	19.0
			5:22	52.79	19.0	5:27	51.33	19.3	5:29	54.37	19.1
			5:44	52.73	19.2	5:48	50.81	19.3	5:51	54.77	19.3
			6: 6	53.63	19.3	6:10	50.51	19.3	6:12	52.90	19.1
			6:28	51.78	19.1	6:31	49.28	19.3	6:34	52.80	19.2
			6:50	52.27	19.2	6:53	48.92	19.4	6:55	52.13	19.1
			7:11	50.75	19.0	7:14	49.30	19.3	7:17	51.19	19.0
			7:32	50.02	19.0	7:36	48.49	19.1	7:38	51.59	19.3
			7:54	50.45	19.3	7:57	47.91	19.0	8: 0	51.82	19.3
			8:15	50.74	19.4	8:19	47.38	19.0	8:21	51.35	19.4
			8:37	50.10	19.3	8:40	49.27	19.0	8:43	50.42	19.0
			8:58	51.44	19.4	9: 2	47.68	18.9	9: 4	50.19	19.0
			9:20	51.31	19.6	9:25	49.56	18.9	9:26	48.97	19.3
			9:42	51.31	19.6	9:45	48.30	19.3	9:47	48.44	19.2
			10: 3	51.55	19.6	10: 7	48.53	19.1	10: 8	48.75	19.2
			10:25	52.49	19.8	10:28	48.14	19.1			
			10:46	52.48	19.5	10:50	48.63	19.0			
			11: 8	52.73	19.4	11:11	48.98	19.1			
11:29	48.37	18.7	11:29	52.45	19.3	11:33	50.39	19.2			
11:48	48.88	18.7	11:51	53.05	19.4	11:54	54.22	19.6			
12: 9	49.51	18.7	12:12	53.35	19.3	12:16	51.37	19.2			
12:31	49.61	18.7	12:34	54.37	19.2	12:37	54.39	19.3			
12:52	51.08	18.7	12:56	54.59	19.3	13: 0	55.47	19.3			
13:14	50.56	18.7	13:17	55.31	19.3	13:20	53.39	19.3			
13:35	52.33	18.8	13:39	56.37	19.3	13:42	54.66	19.3			
13:57	52.94	18.7	14: 0	56.09	19.3	14: 4	53.86	19.3			
14:19	53.57	18.8	14:22	55.61	19.5	14:25	54.41	19.4			
14:40	54.04	18.7	14:43	55.82	19.5	14:47	54.53	19.5			
15: 2	54.59	19.0	15: 5	56.86	19.5	15: 8	53.48	19.4			
15:23	54.57	19.0	15:26	57.05	19.5	15:30	54.87	19.4			
15:45	54.74	19.2	15:48	56.76	19.7	15:51	54.05	19.4			
16: 6	54.90	19.2	16: 9	54.73	19.6	16:13	53.72	19.4			
16:28	56.31	19.3	16:31	56.27	19.6	16:34	55.47	19.3			
16:50	58.06	19.3	16:53	56.76	19.5	16:56	55.76	19.4			
17:11	57.57	19.3	17:14	57.82	19.5	17:17	56.25	19.3			
17:32	56.75	19.3	17:36	57.96	19.5	17:39	58.10	19.3			
17:54	59.79	19.4	17:57	58.55	19.7	18: 0	56.94	19.3			
18:15	58.71	19.4	18:19	58.63	19.6	18:22	57.61	19.6			
18:37	59.94	19.3	18:40	58.51	19.8	18:43	56.40	19.5			
18:58	60.38	19.4	19: 2	59.10	19.6	19: 5	56.92	19.6			
19:20	59.20	19.5	19:23	58.62	19.8	19:26	59.02	19.6			
19:41	60.18	19.5	19:45	56.39	19.5	19:48	56.58	19.6			
20: 3	59.48	19.3	20: 6	58.28	19.6	20: 9	61.89	19.6			
20:25	61.58	19.5	20:28	57.79	19.6	20:31	59.87	19.6			
20:46	59.11	19.3	20:50	57.02	19.7	20:53	60.35	19.5			
21: 8	59.61	19.3	21:11	56.61	19.8	21:14	59.77	19.6			
21:29	59.20	19.5	21:33	57.09	19.7	21:36	61.70	19.6			
21:51	59.04	19.3	21:54	56.99	19.6	21:57	62.39	19.6			
22:12	58.38	19.3	22:16	57.61	19.5	22:19	62.03	19.8			
22:34	59.59	19.5	22:37	56.75	19.6	22:40	63.67	19.6			
22:55	59.06	19.3	23: 0	56.24	19.6	23: 2	61.00	19.4			
23:17	58.67	19.6	23:20	53.61	19.7	23:23	60.02	19.3			
23:38	52.59	19.4	23:42	53.48	19.8	23:45	60.76	19.0			

These data were collected under file GBT#59

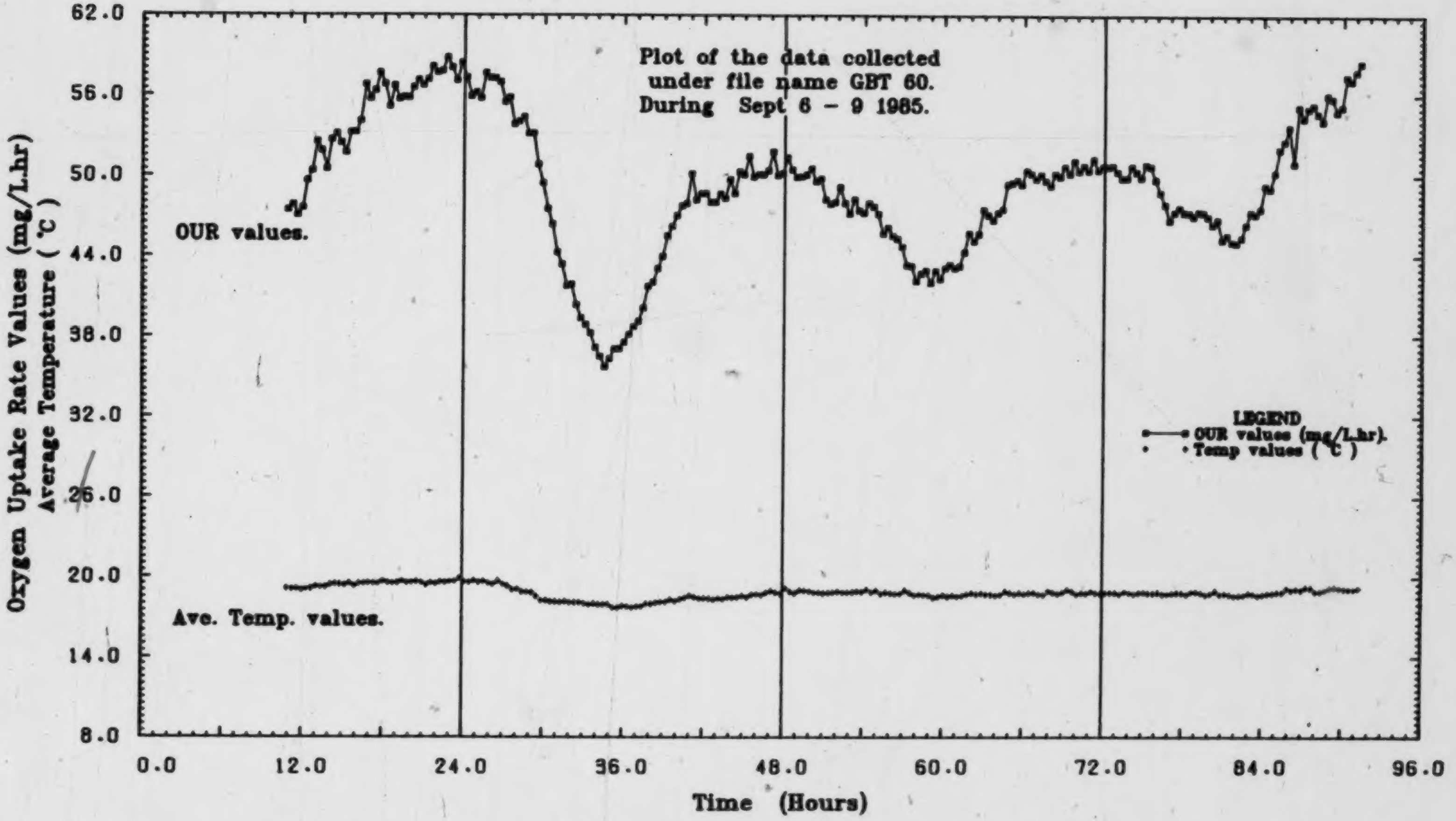


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 6- 9 / 9 / 1985)

DAY 1 6 9 85			DAY 2 7 9 85			DAY 3 8 9 .85			DAY 4 9 9 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 8	57.32	19.6	0:11	51.38	19.2	0:14	50.72	18.8
			0:30	55.93	19.6	0:33	50.46	18.9	0:35	50.77	18.9
			0:51	56.21	19.7	0:54	49.92	18.8	0:57	50.39	18.9
			1:13	55.78	19.6	1:16	49.96	19.0	1:18	49.88	18.8
			1:34	57.65	19.7	1:37	50.11	19.0	1:40	49.89	18.9
			1:56	57.26	19.5	2: 0	50.57	19.0	2: 1	50.74	18.9
			2:17	57.28	19.4	2:20	49.82	18.9	2:23	50.33	18.8
			2:39	56.96	19.7	2:42	48.82	18.9	2:44	49.91	18.9
			3: 1	55.48	19.4	3: 3	48.25	18.8	3: 6	50.85	18.9
			3:22	55.62	19.3	3:25	47.92	18.8	3:27	50.74	18.8
			3:44	53.64	19.0	3:46	46.05	18.9	3:50	49.78	18.8
			4: 5	54.05	19.1	4: 8	49.19	18.9	4:10	48.80	18.9
			4:27	54.37	18.9	4:30	47.89	18.9	4:32	47.90	18.8
			4:48	53.14	18.9	4:51	47.22	18.9	4:53	46.71	18.8
			5:10	53.18	18.8	5:13	48.27	18.9	5:15	47.31	18.8
			5:31	50.85	18.5	5:34	47.44	19.0	5:37	47.85	18.9
			5:53	49.46	18.2	5:56	47.28	18.9	5:58	47.30	18.8
			6:15	47.53	18.2	6:17	47.96	19.1	6:20	47.28	18.7
			6:36	46.39	18.1	6:39	47.73	18.9	6:41	47.02	18.9
			6:58	44.30	18.1	7: 0	47.18	19.0	7: 3	47.35	18.9
			7:19	43.39	18.1	7:22	45.73	18.8	7:25	47.29	18.9
			7:41	41.78	18.2	7:43	46.16	18.9	7:46	45.89	18.7
			8: 2	41.88	18.1	8: 5	45.58	18.8	8: 7	46.40	18.8
			8:24	40.35	18.1	8:26	45.33	18.8	8:29	45.75	19.0
			8:45	39.37	18.1	8:48	44.75	18.8	8:51	45.28	18.8
			9: 7	38.88	18.0	9: 9	43.36	19.0	9:12	45.57	18.8
			9:28	38.26	17.9	9:31	43.28	18.8	9:34	45.09	18.7
			9:50	37.17	18.0	9:52	42.18	18.7	9:55	45.03	18.7
			10:11	38.50	17.9	10:14	42.73	18.7	10:17	45.40	18.7
10:51	47.48	19.1	10:33	38.71	17.9	10:35	42.86	18.7	10:38	46.39	18.7
11:13	47.53	19.1	10:54	38.33	17.9	10:57	42.05	18.7	11: 0	47.30	18.8
11:34	47.09	19.1	11:16	37.05	17.7	11:18	42.93	18.5	11:21	47.19	18.8
11:56	47.81	19.0	11:38	37.09	17.7	11:40	42.34	18.6	11:43	47.88	18.7
12:17	48.88	19.1	12: 0	37.86	17.8	12: 2	43.14	18.7	12: 4	48.30	18.8
12:39	50.40	19.1	12:21	38.19	17.8	12:23	43.40	18.6	12:26	48.10	18.8
13: 0	52.58	19.3	12:42	38.73	17.7	12:45	43.14	18.7	12:48	50.28	18.8
13:22	51.88	19.2	13: 4	39.13	17.8	13: 6	43.29	18.6	13: 9	52.02	18.9
13:44	50.53	19.2	13:25	40.12	17.8	13:28	44.33	18.6	13:31	52.81	18.9
14: 5	52.70	19.4	13:47	41.74	18.0	13:50	45.74	18.7	13:52	53.67	19.2
14:27	53.13	19.4	14: 8	42.08	18.0	14:11	46.18	18.8	14:14	50.98	19.1
14:48	52.45	19.4	14:30	43.07	18.1	14:32	46.89	18.8	14:35	55.19	19.2
15:10	51.72	19.4	14:51	43.87	18.1	14:54	47.50	18.8	14:57	54.38	19.1
15:31	53.25	19.5	15:13	45.54	18.1	15:15	47.11	18.7	15:18	55.06	19.3
15:53	53.27	19.3	15:34	46.23	18.3	15:37	46.75	18.7	15:40	55.32	19.3
16:14	54.10	19.5	15:56	47.04	18.2	16: 0	47.28	18.7	16: 1	54.70	19.0
16:36	55.78	19.5	16:18	47.79	18.3	16:20	47.54	18.7	16:23	54.14	19.0
16:57	55.76	19.5	16:39	47.93	18.4	16:42	48.41	19.0	16:44	56.07	19.1
17:19	56.34	19.5	17: 1	50.19	18.5	17: 3	49.52	18.8	17: 6	55.82	19.3
17:40	57.65	19.5	17:22	48.21	18.5	17:25	49.72	18.8	17:27	54.82	19.3
18: 2	58.62	19.7	17:44	48.88	18.4	17:46	49.40	18.8	17:50	55.20	19.2
18:23	55.18	19.6	18: 5	48.89	18.4	18: 8	50.42	18.8	18:11	57.44	19.2
18:45	56.59	19.5	18:27	48.02	18.4	18:29	50.20	18.8	18:32	57.19	19.1
19: 7	55.72	19.5	18:48	48.04	18.3	18:51	48.81	18.9	18:54	57.83	19.2
19:28	55.85	19.7	19:10	48.88	18.4	19:12	50.12	18.7	19:15	58.48	19.2
19:50	55.81	19.6	19:31	46.33	18.4	19:34	48.87	18.7			
20:11	56.50	19.6	19:53	48.72	18.5	19:55	49.31	19.0			
20:33	57.11	19.6	20:14	48.70	18.4	20:17	50.19	18.9			
20:54	56.75	19.6	20:36	50.21	18.5	20:38	48.89	18.8			
21:16	57.17	19.4	20:57	50.11	18.5	21: 0	50.71	18.9			
21:37	58.11	19.5	21:19	51.47	18.5	21:22	50.22	19.1			
22: 0	57.89	19.5	21:40	48.95	18.7	21:43	51.13	19.0			
22:20	57.81	19.6	22: 2	50.12	18.7	22: 4	50.41	18.7			
22:42	56.78	19.6	22:23	50.10	18.7	22:26	50.78	18.8			
23: 3	56.05	19.7	22:45	50.39	18.8	22:47	50.44	18.8			
23:25	57.08	19.7	23: 7	51.80	19.0	23: 9	51.28	19.0			
23:47	56.40	19.9	23:28	50.05	18.9	23:30	50.46	18.8			

These data were collected under file SBT#80



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 10-13 / 9 / 1985)

DAY 1 10 9 85			DAY 2 11 9 85			DAY 3 12 9 85			DAY 4 13 9 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 3	44.63	19.5	0: 5	42.84	19.9	0: 9	42.11	19.6
			0:25	44.85	19.5	0:27	41.01	19.8	0:30	42.77	19.6
			0:46	44.50	19.5	0:50	40.86	19.7	0:52	44.29	19.5
			1: 8	44.94	19.5	1:10	40.35	19.7	1:14	42.86	19.5
			1:29	44.61	19.6	1:32	40.21	19.7	1:35	42.02	19.4
			1:51	43.98	19.6	1:53	39.61	19.7	1:57	40.77	19.5
			2:12	42.88	19.6	2:15	39.01	19.7	2:18	40.80	19.5
			2:34	41.38	19.4	2:36	39.01	19.7	2:40	39.71	19.4
			2:55	41.39	19.4	2:58	36.31	19.6	3: 1	38.53	19.3
			3:17	41.24	19.4	3:19	37.52	19.7	3:23	38.55	19.6
			3:38	39.56	19.4	3:41	36.21	19.6	3:44	37.79	19.3
			4: 0	39.86	19.3	4: 3	35.98	19.6	4: 6	38.05	19.6
			4:21	39.09	19.2	4:25	35.56	19.6	4:27	37.84	19.6
			4:43	38.91	19.3	4:46	35.90	19.7	4:50	37.07	19.6
			5: 4	37.87	19.3	5: 7	35.52	19.7	5:10	35.57	19.3
			5:26	37.63	19.4	5:29	35.00	19.7	5:32	36.91	19.4
			5:47	38.38	19.5	5:50	35.22	19.7	5:53	35.57	19.3
			6: 9	38.28	19.5	6:12	34.63	19.5	6:15	35.72	19.3
			6:30	37.30	19.4	6:33	33.41	19.5	6:36	35.16	19.3
			6:52	35.98	19.4	6:55	33.33	19.5	6:58	34.79	19.3
			7:13	35.77	19.3	7:16	32.91	19.7	7:19	35.53	19.4
			7:35	35.37	19.3	7:38	32.30	19.5	7:41	35.39	19.3
			7:56	35.23	19.4	8: 0	32.35	19.5	8: 3	35.42	19.4
			8:18	34.80	19.4	8:21	32.44	19.5	8:25	34.49	19.6
			8:40	34.80	19.4	8:43	31.82	19.4	8:46	34.58	19.3
			9: 1	34.45	19.5	9: 4	31.20	19.6	9: 7	35.40	19.3
			9:23	33.15	19.4	9:25	30.86	19.6	9:29	37.08	19.1
			9:44	33.03	19.5	9:47	30.28	19.5	9:50	37.20	18.9
			10: 6	33.56	19.3	10: 9	30.74	19.5	10:12	35.40	18.6
			10:27	33.89	19.3	10:30	31.91	19.3	10:33	35.81	18.6
			10:50	35.00	19.3	10:52	31.30	19.4	10:55	34.98	18.5
			11:10	34.97	19.2	11:14	31.71	19.4	11:18	32.79	18.5
			11:32	35.48	19.3	11:35	32.21	19.3	11:38	30.47	18.1
			11:52	35.33	18.1	11:57	31.48	17.9			
			12:13	35.61	18.1	12:18	31.84	17.9			
12:36	43.49	18.9	12:35	36.39	19.3	12:40	33.72	19.3			
12:58	41.72	18.8	12:56	35.80	19.4	13: 1	33.86	19.4			
13:17	40.07	18.7	13:19	38.84	19.4	13:23	34.88	19.3			
13:38	39.81	18.8	13:41	35.86	19.4	13:44	34.85	19.4			
14: 0	39.35	18.9	14: 2	37.66	19.6	14: 6	35.27	19.4			
14:22	39.47	18.9	14:25	35.78	19.4	14:28	35.60	19.3			
14:44	38.87	19.0	14:46	38.93	19.3	14:50	36.40	19.4			
15: 5	37.86	18.9	15: 7	35.87	19.4	15:11	35.25	19.4			
15:27	37.87	19.0	15:29	36.23	19.5	15:32	35.85	19.5			
15:48	38.05	19.0	15:50	38.26	19.5	15:54	35.79	19.4			
16:10	39.97	19.3	16:12	36.92	19.6	16:15	36.45	19.5			
16:31	39.86	19.0	16:33	36.57	19.6	16:37	37.21	19.7			
16:53	40.11	19.1	16:55	39.04	19.7	16:58	37.88	19.6			
17:14	39.39	19.2	17:18	37.57	19.8	17:20	39.21	19.8			
17:36	38.12	19.3	17:38	38.01	19.6	17:41	40.25	19.9			
17:57	39.69	19.1	18: 0	38.89	19.6	18: 3	40.53	20.1			
18:19	40.82	19.2	18:21	38.50	19.7	18:25	40.14	19.6			
18:40	40.30	19.3	18:42	38.72	19.8	18:46	41.51	19.8			
19: 2	40.42	19.3	19: 4	38.82	19.5	19: 8	41.38	19.8			
19:23	41.05	19.3	19:25	38.76	19.5	19:29	41.93	20.0			
19:45	41.90	19.2	19:47	38.41	19.5	19:51	41.09	19.9			
20: 6	42.69	19.5	20: 9	38.87	19.5	20:12	41.25	19.7			
20:28	43.61	19.5	20:30	38.95	19.5	20:34	41.11	19.7			
20:50	41.77	19.5	20:52	38.02	19.5	20:55	41.82	19.9			
21:11	42.32	19.6	21:13	38.71	19.6	21:17	41.41	19.7			
21:32	42.02	19.3	21:35	38.72	19.5	21:38	42.70	19.9			
21:54	42.35	19.3	21:56	40.03	19.6	22: 0	43.35	20.0			
22:15	42.66	19.3	22:18	39.72	19.6	22:21	43.85	19.6			
22:37	43.72	19.3	22:39	40.88	19.5	22:43	42.86	19.9			
22:58	43.34	19.3	23: 1	40.70	19.6	23: 4	40.07	19.7			
23:20	43.54	19.4	23:22	41.76	19.7	23:26	38.90	19.7			
23:41	44.37	19.4	23:44	41.88	19.8	23:47	40.17	19.7			

These data were collected under file SBT#51

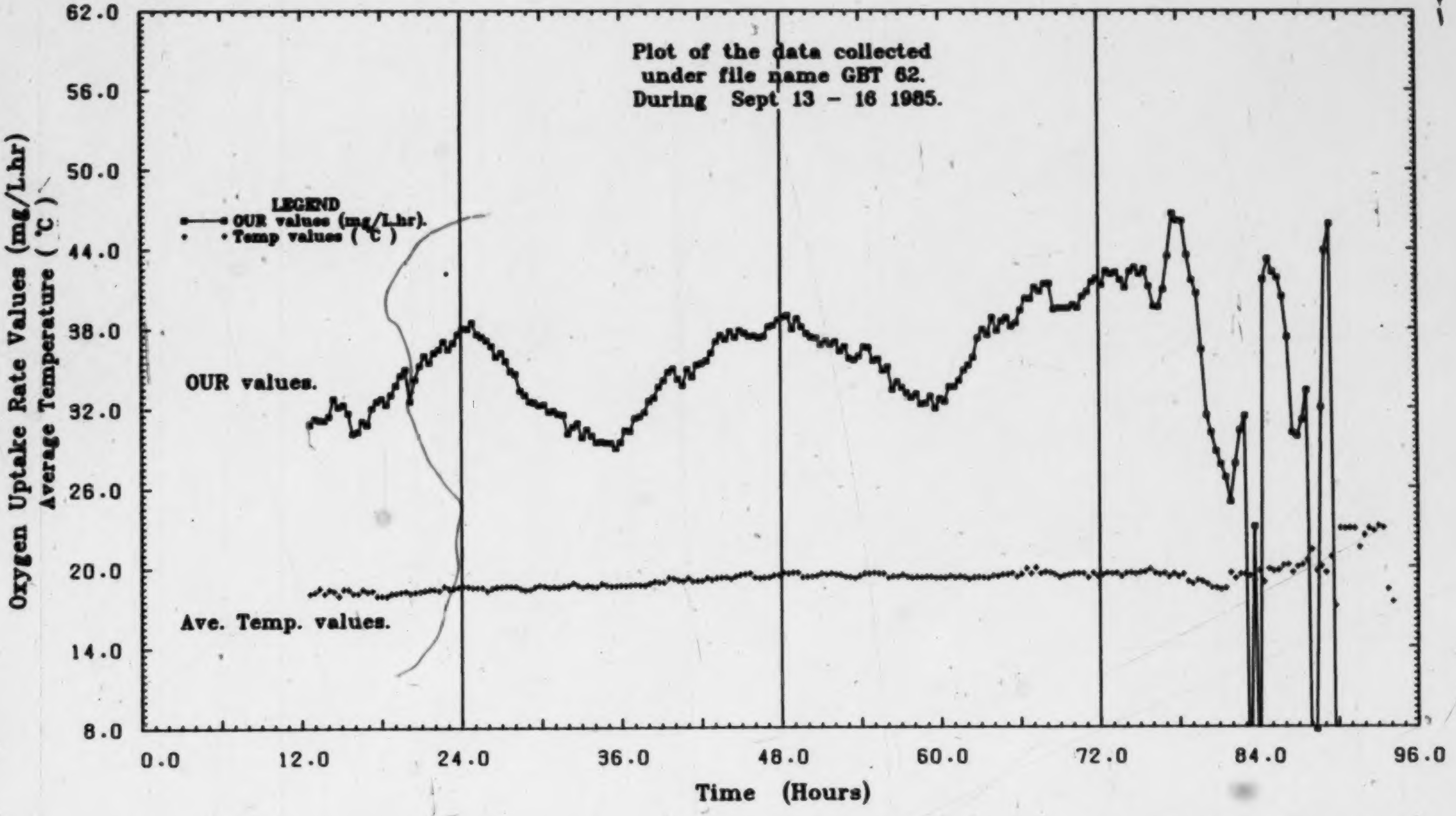
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 13-16 / 9 / 1988)

DAY 1			DAY 2			DAY 3			DAY 4		
13 9 88			14 9 88			15 9 88			16 9 88		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 5	38.04	18.7	0: 8	38.86	19.6	0:11	41.25	19.4
			0:27	38.00	18.8	0:30	38.95	19.6	0:32	42.31	19.6
			0:48	38.47	18.8	0:51	37.93	19.6	0:54	42.08	19.5
			1:10	37.80	18.8	1:13	38.71	19.6	1:15	42.20	19.6
			1:31	37.40	18.8	1:34	38.10	19.3	1:37	41.65	19.3
			1:53	37.12	18.3	1:55	37.59	19.3	1:58	41.05	19.6
			2:15	36.70	18.5	2:17	37.32	19.2	2:20	42.28	19.6
			2:36	35.80	18.6	2:38	37.26	19.4	2:41	42.57	19.5
			2:58	36.19	18.8	3: 0	38.75	19.6	3: 3	42.09	19.6
			3:19	35.57	18.7	3:22	37.03	19.5	3:25	42.46	19.7
			3:41	34.83	18.7	3:43	36.78	19.6	3:46	41.17	19.9
			4: 2	34.60	18.7	4: 5	35.97	19.5	4: 8	39.64	19.6
			4:25	33.36	18.5	4:26	36.37	19.4	4:29	39.61	19.5
			4:46	33.02	18.4	4:48	35.59	19.3	4:51	40.93	19.6
			5: 7	32.52	18.4	5: 9	36.72	19.3	5:12	43.45	19.3
			5:28	32.45	18.6	5:31	35.59	19.2	5:34	46.66	19.5
			5:50	32.23	18.7	5:52	35.66	19.3	5:55	46.12	19.3
			6:11	32.28	18.7	6:14	36.56	19.5	6:17	45.10	19.5
			6:33	31.75	18.8	6:35	36.52	19.5	6:39	43.53	18.9
			6:54	31.81	18.6	6:57	35.55	19.6	7: 0	41.84	18.8
			7:15	31.58	18.5	7:18	35.65	19.5	7:22	40.68	19.1
			7:36	31.50	18.7	7:40	34.61	19.6	7:43	36.39	18.9
			8: 0	30.10	18.7	8: 2	35.05	19.2	8: 5	31.43	18.7
			8:21	30.60	18.9	8:23	33.37	19.3	8:26	30.12	18.5
			8:42	30.88	18.7	8:45	33.94	19.3	8:48	28.72	18.4
			9: 4	29.81	18.8	9: 6	33.61	19.4	9: 9	27.73	18.3
			9:25	30.39	18.7	9:28	33.09	19.3	9:31	25.74	18.4
			9:47	29.54	18.8	9:50	32.78	19.2	9:52	24.94	18.8
			10: 8	29.45	18.8	10:11	33.03	19.3	10:14	27.79	19.2
			10:30	29.48	18.8	10:32	32.27	19.2	10:35	30.30	18.5
			10:51	29.41	18.7	10:54	32.34	19.3	10:57	31.37	19.5
			11:13	29.39	18.8	11:15	32.86	19.3	11:18	-0.87	19.4
			11:35	28.99	18.7	11:37	31.97	19.2	11:40	23.05	19.0
			11:56	28.42	18.7	11:58	32.97	19.2	12: 2	0.54	19.7
			12:18	30.34	18.7	12:20	32.46	19.2	12:23	41.70	18.8
12:38	30.83	18.1	12:39	30.28	18.7	12:41	33.57	19.3	12:45	43.23	19.9
12:58	31.27	18.3	13: 1	31.25	18.8	13: 3	33.59	19.2	13: 6	42.27	19.7
13:19	31.18	18.5	13:22	31.36	18.7	13:25	34.08	19.3	13:28	41.83	19.8
13:41	31.13	18.2	13:44	31.57	18.7	13:46	34.82	19.3	13:50	40.42	20.1
14: 2	31.44	18.4	14: 5	32.51	18.8	14: 7	35.20	19.1	14:11	37.34	20.2
14:25	32.77	18.3	14:27	32.77	19.0	14:29	35.79	19.2	14:32	30.12	19.6
14:46	32.18	18.0	14:48	33.58	18.9	14:50	37.23	19.3	14:54	28.64	20.0
15: 7	32.32	18.5	15:10	34.07	18.9	15:12	37.88	19.2	15:16	31.06	20.2
15:28	31.89	18.5	15:31	34.70	19.2	15:34	37.46	19.2	15:37	33.32	20.5
15:50	30.15	18.2	15:53	34.84	19.2	15:55	38.78	19.4	16: 0	1.14	21.3
16:12	30.28	18.2	16:15	34.18	19.1	16:17	37.80	19.3	16:20	7.62	19.7
16:33	31.06	18.5	16:36	33.69	19.0	16:38	36.51	19.5	16:42	32.05	20.1
16:55	30.41	18.3	16:58	34.81	19.2	17: 0	38.78	19.4	17: 3	43.60	19.8
17:16	32.06	18.3	17:19	34.24	19.0	17:21	36.12	19.6	17:25	45.60	20.6
17:38	32.56	17.9	17:41	35.24	19.0	17:43	38.38	19.3	17:46	1.22	17.1
18: 0	32.78	18.0	18: 2	35.36	19.0	18: 4	39.34	19.5	18: 8	0.77	22.9
18:21	32.32	17.9	18:25	35.65	19.3	18:26	40.21	19.6	18:29	0.02	22.9
18:42	33.08	~~18.1~~	18:45	36.13	19.1	18:47	40.19	19.6	18:51	1.04	22.9
19: 4	33.78	18.2	19: 7	37.00	19.2	19: 9	41.04	20.0	19:13	1.23	22.9
19:25	34.61	18.2	19:28	37.48	12.3	19:31	40.75	19.5	19:34	0.66	21.5
19:47	34.88	18.3	19:50	37.18	19.3	19:52	41.33	19.7	19:56	0.66	22.4
20: 8	32.56	18.2	20:11	37.75	19.2	20:14	41.33	19.6	20:17	1.15	22.9
20:30	34.20	18.2	20:33	37.32	19.4	20:36	39.40	19.5	20:38	1.14	22.7
20:52	35.24	18.3	20:54	37.83	19.5	20:57	38.50	19.2	21: 0	0.90	23.1
21:13	35.86	18.4	21:16	37.64	19.5	21:18	38.49	19.4	21:22	1.30	23.0
21:35	35.49	18.4	21:38	37.36	19.6	21:40	38.80	19.4	21:43	-0.14	18.4
21:56	36.21	18.4	22: 0	37.42	19.3	22: 2	39.75	19.6	22: 5	1.22	17.4
22:18	36.45	18.4	22:21	37.27	19.2	22:23	39.53	19.5			
22:39	37.05	18.7	22:42	37.39	19.3	22:45	40.38	19.5			
23: 1	36.48	18.5	23: 4	38.11	19.3	23: 6	40.73	19.2			
23:22	36.83	18.5	23:25	38.23	19.4	23:28	41.48	19.6			
23:44	37.80	18.6	23:47	38.81	19.5	23:50	41.79	19.3			

These data were collected under file SBT#82



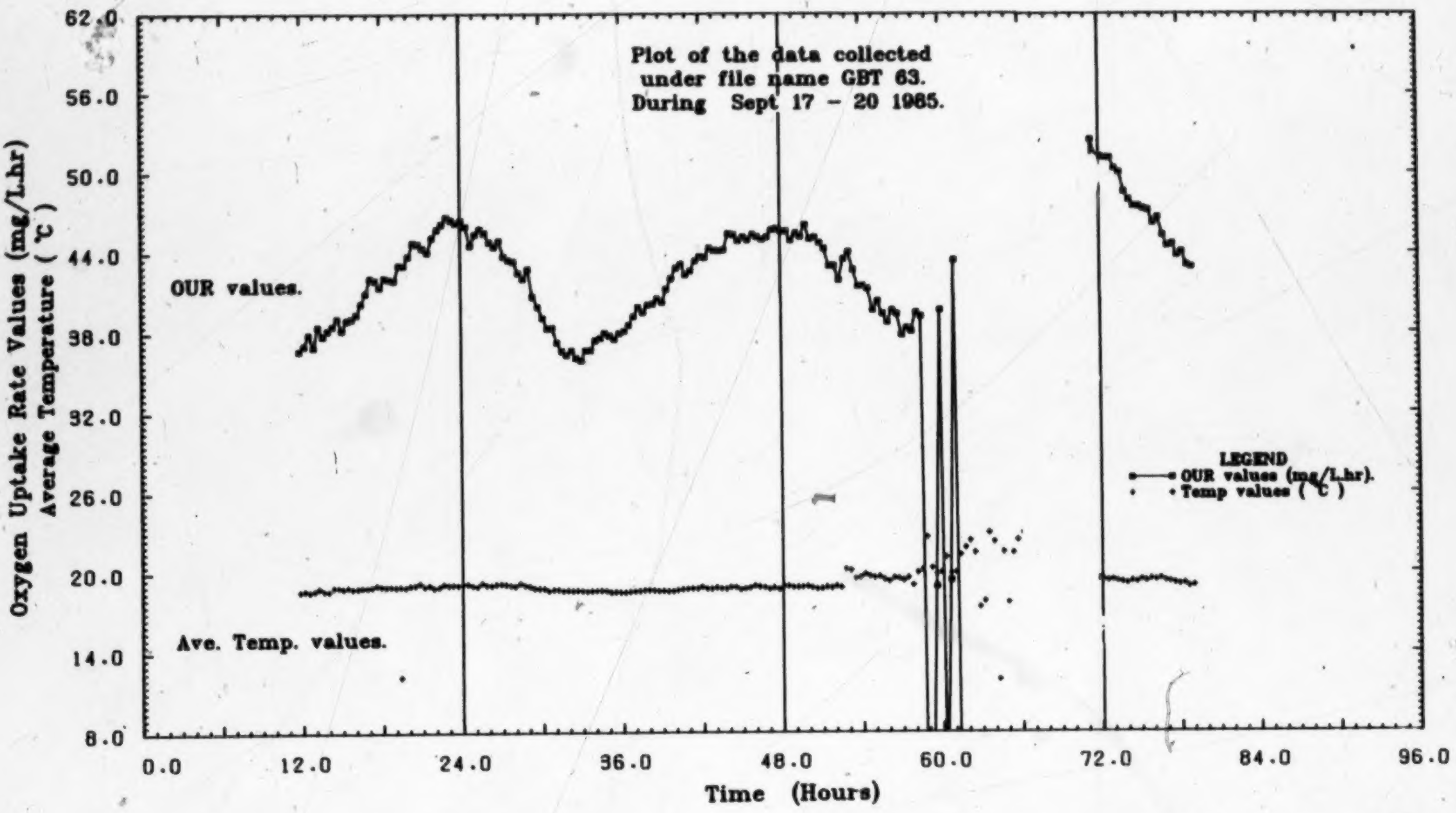
Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 17-20 / 9 / 1985)

DAY 1 17 9 85			DAY 2 18 9 85			DAY 3 19 9 85			DAY 4 20 9 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 0	46.41	19.2	0: 2	45.59	18.9	**:**	223.53	12.1
			0:21	45.87	19.2	0:25	45.58	19.0	18:42	-0.27	23.2
			0:43	44.55	19.1	0:46	44.91	18.9	**:**	225.10	8.5
			1: 4	45.36	19.0	1: 7	45.44	18.9	19:25	0.17	11.7
			1:26	45.77	19.3	1:28	45.19	18.9	19:47	1.85	8.4
			1:47	45.47	19.1	1:50	46.06	18.9	20: 8	-0.45	22.4
			2: 9	44.80	19.1	2:11	45.01	18.8	20:30	1.40	12.0
			2:30	44.46	19.2	2:33	46.13	18.7	20:51	1.13	22.4
			2:52	44.90	19.2	2:55	44.71	18.8	21:13	1.66	12.0
			3:13	43.73	19.2	3:16	44.28	18.9	21:34	1.46	8.4
			3:35	43.46	19.1	3:38	42.97	18.8	21:56	1.09	8.4
			3:56	43.34	19.0	4: 0	42.96	18.9	**:**	1.07	12.2
			4:18	42.49	19.3	4:21	41.91	18.8	22:38	0.43	18.4
			4:39	42.05	19.1	4:42	43.49	20.2	23: 0	0.78	12.1
			5: 1	42.77	19.0	5: 4	44.02	20.1	23:22	52.46	18.5
			5:22	40.70	18.8	5:25	42.68	19.5	23:43	51.24	18.6
			5:44	39.85	18.8	5:47	41.46	19.6	0: 5	51.21	18.5
			6: 5	39.11	18.8	6: 8	41.45	19.6	0:26	51.13	18.4
			6:27	38.33	18.7	6:30	41.26	19.7	0:48	51.12	18.5
			6:50	38.36	18.8	6:51	39.85	19.6	1: 9	50.32	18.4
			7:10	37.28	18.8	7:13	40.31	19.6	1:31	50.02	18.3
			7:32	38.62	18.7	7:35	39.36	19.4	1:52	48.58	18.2
			7:53	38.33	18.7	7:56	38.74	19.3	2:14	47.97	18.4
			8:15	38.87	18.7	8:18	39.62	19.6	2:35	47.49	18.3
			8:36	38.12	18.7	8:39	39.35	19.5	2:57	47.48	18.5
			8:58	38.93	18.7	9: 1	37.78	19.4	3:18	47.30	19.3
			9:19	38.87	18.8	9:22	38.30	19.6	3:40	47.16	18.5
			9:41	38.70	18.8	9:44	38.06	19.0	4: 2	46.24	18.4
			10: 2	37.43	18.7	10: 5	39.45	20.0	4:23	46.53	18.6
			10:25	37.59	18.7	10:27	39.18	20.2	4:45	45.32	18.4
			10:45	37.96	18.7	10:48	0.96	22.6	5: 6	44.52	18.3
			11: 7	37.77	18.5	11:10	0.80	20.3	5:28	44.85	18.2
11:47	36.89	18.6	11:28	37.52	18.6	11:31	18.90	19.6	5:50	43.80	18.1
12: 9	37.07	18.7	11:50	37.94	18.5	11:53	39.64	20.0	6:11	44.04	18.2
12:30	37.90	18.6	12:12	38.10	18.5	12:14	2.29	21.1	6:32	43.07	18.9
12:52	36.97	18.7	12:33	38.54	18.6	12:36	19.36	19.9	6:54	42.92	19.0
13:13	36.46	18.9	12:55	39.22	18.6	12:58	43.37	20.0			
13:35	37.80	18.7	13:16	38.86	18.6	13:19	1.53	21.3			
13:56	38.20	18.7	13:38	39.51	18.7	13:41	1.13	21.8			
14:18	36.94	18.9	14: 0	40.06	18.7	14: 2	2.22	22.3			
14:40	39.12	18.8	14:21	40.14	18.7	14:25	2.57	21.4			
15: 1	38.24	18.6	14:42	40.53	18.6	14:46	0.25	17.4			
15:23	38.97	18.8	15: 4	40.28	18.7	15: 7	0.72	17.8			
15:44	39.09	18.6	15:25	41.25	18.6	15:28	-0.72	22.9			
16: 6	39.41	18.8	15:47	42.05	18.6	15:50	1.82	22.3			
16:27	40.22	18.9	16: 8	42.82	18.7	16:11	1.06	11.8			
16:50	41.00	18.9	16:30	43.10	18.6	16:33	2.88	21.8			
17:10	42.09	19.0	16:51	42.32	18.6	16:54	1.41	17.7			
17:32	41.94	19.1	17:13	42.80	18.6	17:16	2.07	21.4			
17:53	41.45	19.0	17:35	43.36	18.6	17:37	0.92	22.4			
18:15	42.11	19.0	17:56	43.88	18.6	18: 0	0.46	22.8			
18:36	42.04	19.0	18:18	43.83	18.6	**:**	-223.53	12.1			
18:58	41.94	19.0	18:39	44.31	18.6	18:42	-0.27	23.2			
19:19	43.09	19.0	19: 1	44.15	18.6	**:**	-225.10	8.5			
19:41	43.04	18.9	19:22	44.12	18.6	19:25	0.17	11.7			
20: 2	43.74	19.1	19:44	44.18	18.6	19:47	1.85	8.4			
20:25	44.74	19.1	20: 5	45.40	18.9	20: 8	-0.45	22.4			
20:46	44.85	19.2	20:27	45.32	18.9	20:30	1.40	12.0			
21: 7	44.35	19.0	20:48	44.87	18.7	20:51	1.13	22.4			
21:29	44.04	19.1	21:10	45.15	18.8	21:13	1.66	12.0			
21:50	45.14	18.9	21:31	44.94	18.8	21:34	1.46	8.4			
22:12	45.74	19.0	21:53	45.35	19.0	21:56	1.09	8.4			
22:33	46.13	19.2	22:14	45.18	18.9	**:**	1.07	12.2			
22:55	46.66	19.1	22:36	44.97	18.9	22:38	0.43	18.4			
23:16	46.45	19.1	22:58	45.15	18.7	23: 0	0.78	12.1			
23:38	46.22	19.1	23:19	45.70	18.8	23:22	52.46	18.5			

These data were collected under file GBT#63

*** NOTE: 1. THERE ARE SOME DATA VALUES THAT HAVE NOT BEEN PRINTED



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

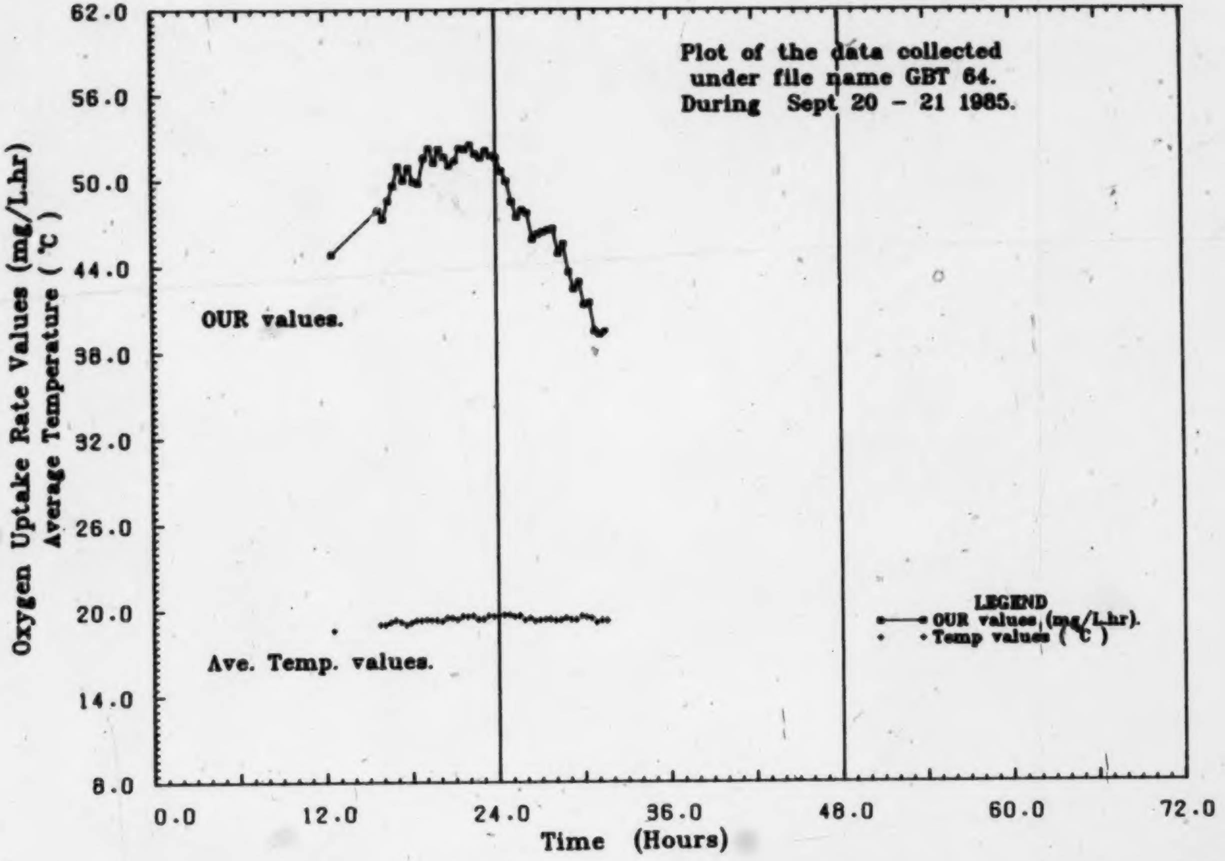
The Results of The Automated

Oxygen Uptake Rate Apparatus.

(For the period of 20-21 / 9 / 1985)

DAY 1			DAY 2		
20 9 85			21 9 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 0	51.57	19.6
			0:21	50.53	19.7
			0:42	49.53	19.7
			1: 4	48.40	19.6
			1:25	47.43	19.6
			1:47	47.92	19.3
			2: 8	47.71	19.5
			2:30	45.85	19.2
			2:51	46.20	19.3
			3:13	46.36	19.3
			3:34	46.49	19.3
			3:56	46.89	19.3
			4:18	44.66	19.3
			4:39	45.52	19.4
			5: 1	43.57	19.3
			5:23	42.40	19.3
			5:44	42.86	19.5
			6: 5	41.29	19.5
			6:27	41.42	19.4
			6:48	39.43	19.1
			7:10	39.24	19.3
			7:31	39.39	19.2
			7:53	38.72	19.3
			8:14	38.27	19.3
			8:36	38.47	19.6
			8:58	38.04	19.0
			9:19	37.36	19.0
			9:41	37.73	19.0
			10: 3	37.58	18.9
			10:25	37.47	19.0
			10:46	37.19	19.0
			11: 7	37.30	19.0
			11:28	38.33	19.3
			11:50	37.75	19.3
12:30	44.84	18.8			
15:44	47.81	19.0			
16: 5	47.28	19.0			
16:27	48.59	19.2			
16:48	49.84	19.3			
17:10	50.98	19.2			
17:32	50.01	19.0			
17:53	50.86	19.2			
18:15	49.80	19.3			
18:36	49.77	19.3			
18:58	51.55	19.4			
19:19	52.21	19.3			
19:41	51.24	19.3			
20: 2	52.17	19.3			
20:25	51.63	19.5			
20:46	51.03	19.5			
21: 7	51.36	19.4			
21:28	52.24	19.6			
21:50	52.17	19.6			
22:12	52.46	19.6			
22:33	51.86	19.4			
22:55	51.59	19.4			
23:16	52.09	19.6			
23:38	51.72	19.6			

These data were collected under file CBT#84

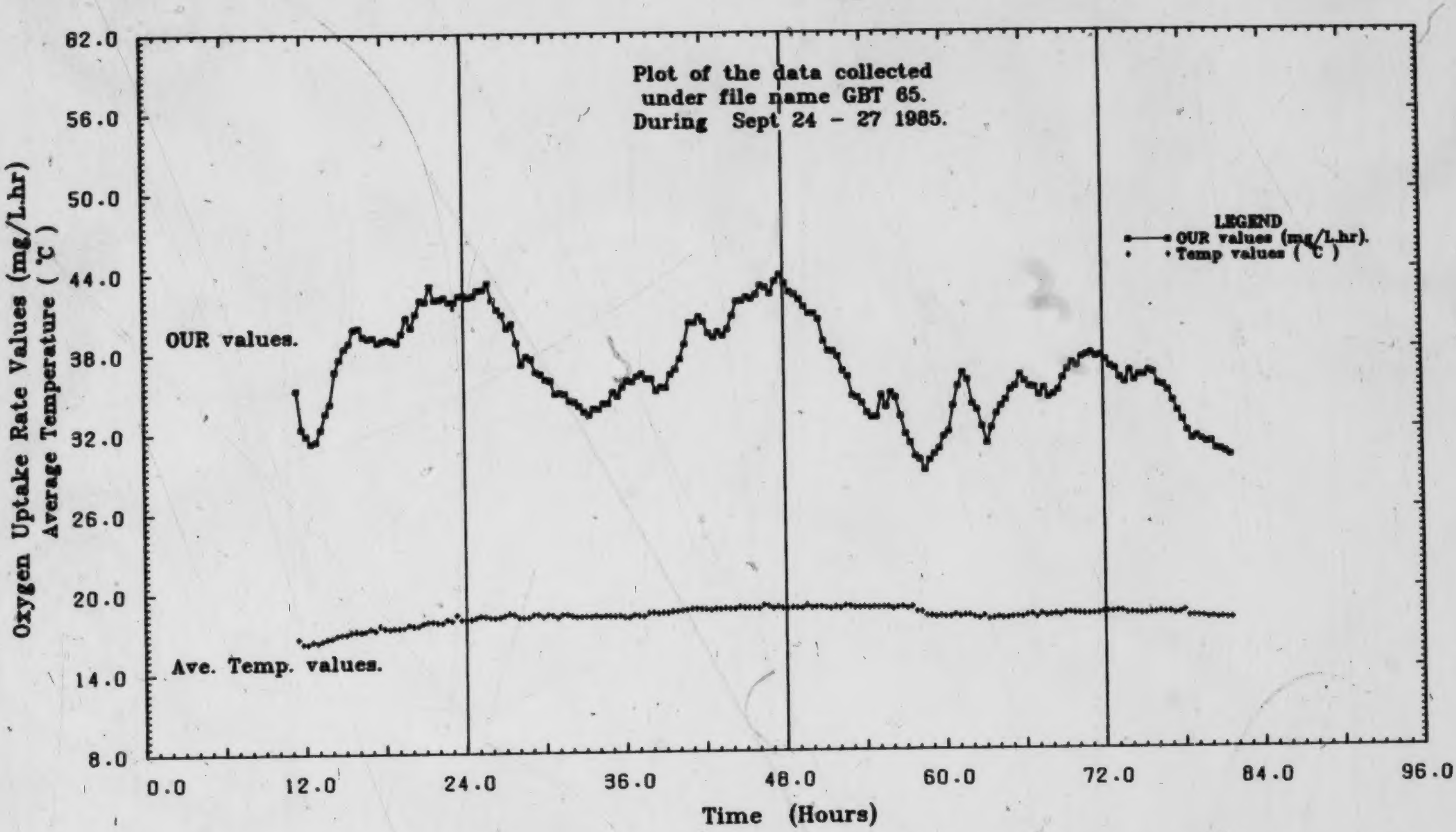


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T, Plant.

The Results of the Automated
Oxygen Uptake Rate Apparatus.
(For the period of 24-27 / 9 / 1985)

DAY 1 24 9 85			DAY 2 25 9 85			DAY 3 26 9 85			DAY 4 27 9 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 0	42.32	18.0	0: 5	43.05	18.7	0:11	37.13	18.3
			0:21	42.17	18.0	0:27	42.40	18.7	0:32	36.85	18.2
			0:43	42.29	18.2	0:48	42.21	18.7	0:54	36.46	18.3
			1: 4	42.88	18.3	1:10	41.84	18.7	1:15	35.77	18.3
			1:26	42.74	18.2	1:31	41.28	18.8	1:37	35.48	18.1
			1:48	43.20	18.2	1:53	40.78	18.7	2: 0	36.31	18.3
			2: 9	41.96	18.2	2:14	40.78	18.7	2:20	35.80	18.1
			2:31	41.25	18.2	2:36	40.31	18.8	2:42	35.88	18.1
			2:52	40.87	18.3	2:58	38.86	18.7	3: 3	35.98	18.1
			3:14	39.83	18.6	3:19	37.95	18.6	3:25	36.30	18.1
			3:35	40.15	18.4	3:41	37.90	18.7	3:46	35.15	18.1
			3:57	38.74	18.2	4: 2	37.51	18.8	4: 8	36.31	18.2
			4:18	37.11	18.2	4:24	36.43	18.8	4:29	35.21	18.2
			4:40	37.70	18.2	4:46	36.00	18.8	4:51	34.80	18.2
			5: 2	37.51	18.4	5: 7	34.57	18.7	5:~~13~~	34.02	18.0
			5:23	36.52	18.4	5:29	34.41	18.7	5:34	33.24	18.1
			5:45	36.37	18.2	5:50	33.99	18.7	5:56	32.67	18.3
			6: 6	35.95	18.4	6:12	33.27	18.7	6:17	31.76	17.9
			6:28	35.65	18.3	6:33	32.94	18.7	6:39	31.13	17.8
			6:50	34.88	18.1	6:55	32.94	18.7	7: 0	31.34	17.8
			7:11	34.83	18.4	7:17	34.58	18.7	7:22	31.11	17.8
			7:33	34.86	18.4	7:38	33.65	18.7	7:44	30.66	17.7
			7:55	34.35	18.3	8: 0	34.73	18.5	8: 5	30.83	17.8
			8:16	34.26	18.2	8:21	34.33	18.7	8:27	30.36	17.7
			8:38	33.95	18.2	8:43	32.98	18.7	8:48	30.33	17.8
			9: 0	33.52	18.2	9: 5	31.66	18.6	9:10	30.14	17.7
			9:21	33.27	18.2	9:26	30.89	18.7	9:31	28.81	17.7
			9:42	33.74	18.3	9:48	29.89	18.3			
			10: 4	33.72	18.2	10: 9	29.72	18.3			
			10:25	34.12	18.2	10:31	28.94	18.0			
			10:47	34.14	18.2	10:53	28.69	18.0			
			11: 9	34.88	18.2	11:14	30.13	17.9			
11:25	35.30	16.7	11:30	34.58	18.2	11:36	30.55	18.0			
11:47	32.40	16.3	11:52	35.33	18.1	11:57	31.45	17.9			
12: 8	31.89	16.3	12:13	35.61	18.1	12:19	31.84	17.9			
12:30	31.32	16.5	12:35	35.74	18.3	12:40	33.76	18.1			
12:52	31.46	16.4	12:56	36.13	18.2	13: 2	36.22	17.9			
13:13	32.36	16.6	13:18	36.33	18.2	13:24	36.22	18.0			
13:35	33.57	16.6	13:40	35.95	18.4	13:45	35.69	18.0			
13:56	34.29	16.7	14: 1	35.84	18.4	14: 7	33.64	17.9			
14:18	36.59	16.8	14:23	35.04	18.4	14:28	33.42	17.8			
14:39	37.60	17.0	14:44	35.32	18.4	14:50	32.17	18.0			
15: 1	38.39	17.0	15: 6	35.26	18.4	15:12	30.94	17.7			
15:22	38.62	17.1	15:27	36.27	18.5	15:33	32.06	17.8			
15:44	39.84	17.2	15:50	36.88	18.5	15:55	33.12	17.8			
16: 6	39.53	17.2	16:11	37.42	18.6	16:16	[illegible].69	17.8			
16:27	39.32	17.2	16:32	38.52	18.6	16:38	34.15	17.8			
16:50	39.16	17.4	16:54	40.12	18.7	17: 0	34.83	17.9			
17:10	39.22	17.3	17:15	40.11	18.7	17:21	35.20	17.8			
17:32	38.63	17.5	17:37	40.58	18.7	17:43	36.05	17.9			
17:53	38.88	17.4	17:58	40.21	18.7	18: 4	35.58	18.0			
18:15	39.09	17.4	18:20	39.33	18.8	18:26	36.17	18.1			
18:36	38.97	17.4	18:42	39.02	18.7	18:47	35.11	17.8			
18:58	38.62	17.4	19: 3	39.43	18.7	19: 9	34.62	18.1			
19:19	38.91	17.5	19:25	39.15	18.7	19:31	35.03	17.9			
19:41	40.88	17.7	19:46	39.83	18.7	19:52	34.38	18.0			
20: 3	39.94	17.6	20: 8	40.83	18.7	20:14	34.55	18.1			
20:25	40.87	17.6	20:29	41.72	18.8	20:35	34.86	18.0			
20:46	41.88	17.6	20:51	41.76	18.7	20:57	35.78	18.1			
21: 7	41.69	17.8	21:12	42.02	18.7	21:18	36.42	18.2			
21:29	43.02	17.8	21:34	41.91	18.7	21:40	36.94	18.1			
21:50	42.03	17.6	21:55	42.22	18.7	22: 1	36.71	18.1			
22:12	42.05	17.6	22:17	42.89	18.9	22:23	37.38	18.1			
22:33	42.19	18.1	22:38	42.73	18.8	22:45	37.52	18.1			
22:55	41.65	18.0	23: 0	42.26	18.7	23: 6	37.68	18.1			
23:17	41.63	18.4	23:22	43.21	18.8	23:28	37.39	18.1			
23:38	42.28	18.0	23:43	43.70	18.7	23:50	37.46	18.2			

These data were collected under file GBT#85

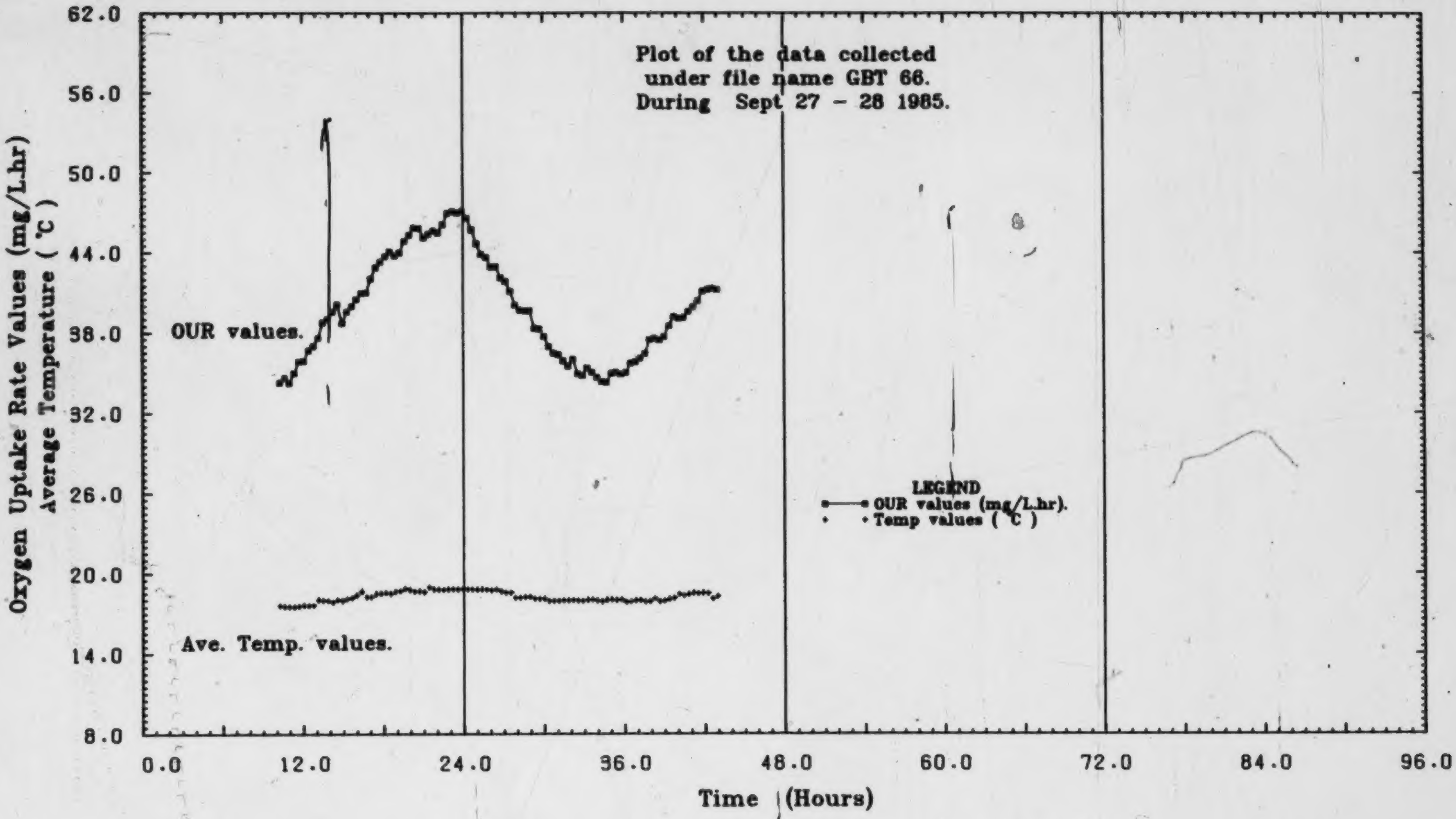


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 27-28 / 9 / 1985)

DAY 1 27 9 85			DAY 2 28 9 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:16	46.56	18.9
			0:37	45.72	18.9
			1: 0	44.66	18.8
			1:20	43.86	18.8
			1:42	43.65	18.8
			2: 3	42.95	18.8
			2:25	42.57	18.8
			2:47	42.14	18.7
			3: 8	41.68	18.6
			3:30	41.11	18.6
			3:51	40.06	18.2
			4:13	39.71	18.2
			4:35	39.66	18.3
			4:56	38.86	18.3
			5:18	38.34	18.1
			5:39	38.29	18.1
			6: 1	37.73	18.1
			6:22	36.97	18.0
			6:44	36.48	18.0
			7: 6	36.37	18.0
			7:27	35.90	18.0
			7:50	35.52	18.0
			8:10	35.01	18.0
			8:32	34.94	18.0
			8:53	34.60	18.0
			9:15	35.36	18.0
			9:36	35.04	18.1
			9:58	34.85	18.0
			10:20	34.34	17.9
10:14	34.31	17.6	10:41	34.28	18.0
10:36	34.66	17.8	11: 3	34.95	18.1
10:57	34.27	17.6	11:25	35.02	18.0
11:19	35.02	17.5	11:46	34.89	18.1
11:40	35.50	17.6	12: 8	35.00	17.9
12: 2	35.92	17.7	12:29	35.70	17.9
12:25	36.72	17.8	12:51	35.81	18.0
12:45	37.03	17.7	13:12	36.08	18.0
13: 7	37.65	18.1	13:34	36.43	17.9
13:28	38.60	18.0	13:55	37.47	17.9
13:50	39.06	18.0	14:17	37.86	18.2
14:12	39.59	17.9	14:38	37.43	17.9
14:33	40.15	18.1	15: 0	37.69	18.0
14:55	38.74	18.0	15:22	38.50	18.1
15:16	39.50	18.2	15:43	39.18	18.2
15:38	40.01	18.2	16: 5	39.08	18.5
16: 0	40.52	18.4	16:27	39.12	18.4
16:21	41.00	18.7	16:48	39.57	18.4
16:43	41.04	18.3	17:10	39.92	18.5
17: 4	42.08	18.3	17:31	40.37	18.6
17:26	42.91	18.5	17:53	41.10	18.5
17:47	43.32	18.5	18:15	41.23	18.5
18: 9	43.74	18.6	18:36	41.31	18.1
18:30	44.08	18.5	18:58	41.23	18.3
18:52	43.79	18.7			
19:13	43.99	18.7			
19:35	44.66	18.9			
19:57	45.34	18.8			
20:18	45.57	18.7			
20:40	45.63	18.7			
21: 1	45.13	18.7			
21:23	45.39	19.0			
21:45	45.64	18.8			
22: 6	45.49	18.8			
22:28	46.11	18.8			
22:50	46.57	18.8			
23:11	47.11	18.9			
23:32	46.99	18.8			
23:54	47.10	18.9			

These data were collected under file GBT#86

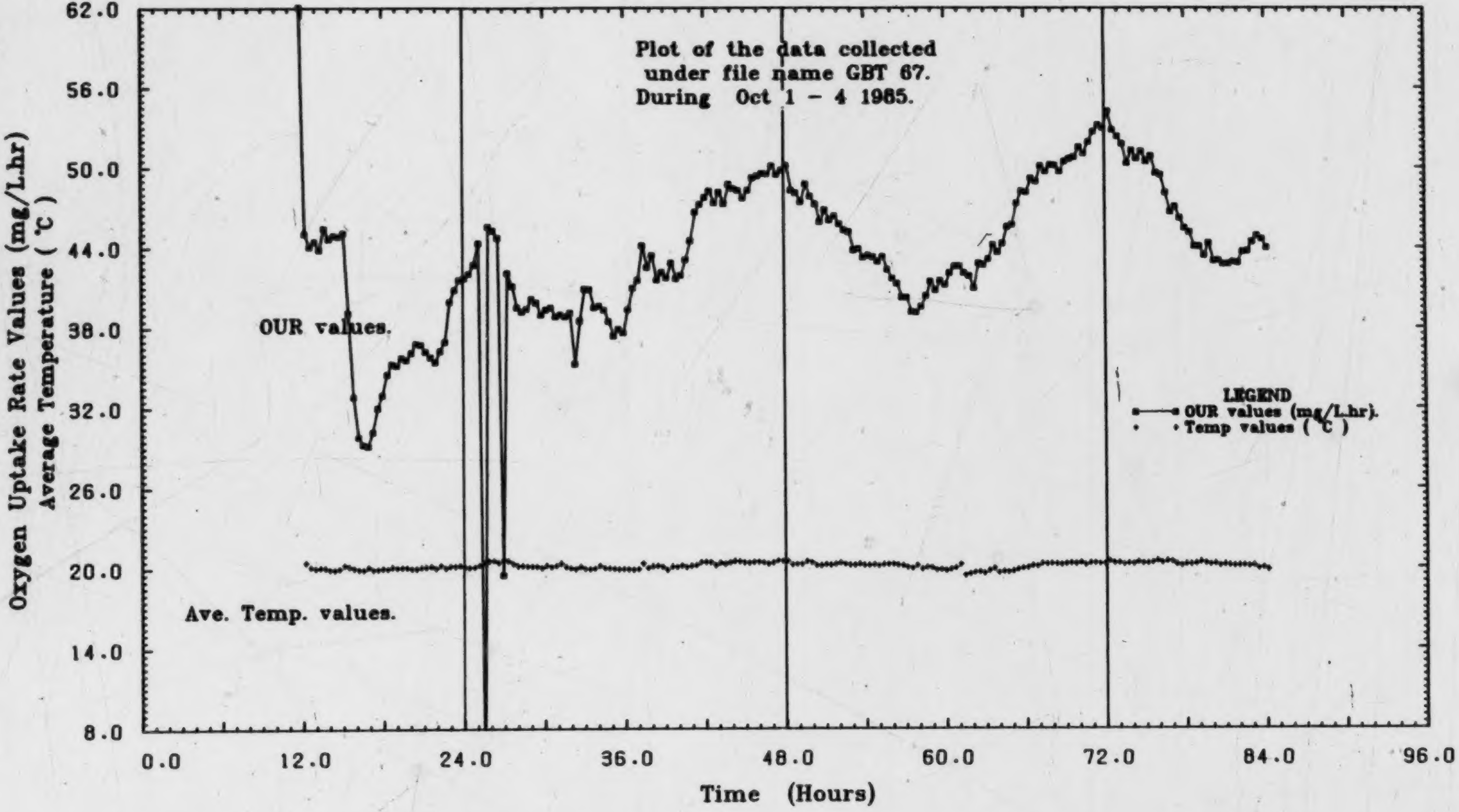


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 1- 4 / 10 / 1985)

DAY 1 1 10 85			DAY 2 2 10 85			DAY 3 3 10 85			DAY 4 4 10 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0: 3	41.73	20.2	0: 8	50.14	20.5	0:13	54.22	20.5
			0:25	42.06	20.1	0:30	48.26	20.3	0:34	52.60	20.4
			0:46	42.73	20.1	0:51	48.07	20.3	0:56	52.31	20.4
			1: 8	44.32	20.3	1:13	47.41	20.3	1:18	51.75	20.3
			1:29	2.18	20.5	1:35	46.72	20.5	1:39	50.31	20.3
			1:51	45.56	20.5	1:56	47.62	20.4	2: 1	51.27	20.3
			2:12	46.27	20.6	2:18	47.24	20.2	2:22	50.66	20.5
			2:34	44.73	20.5	2:39	45.91	20.2	2:44	51.16	20.4
			2:55	19.52	20.7	3: 1	46.78	20.3	3: 5	50.44	20.4
			3:17	42.10	20.6	3:22	46.02	20.2	3:27	50.64	20.4
			3:38	41.12	20.4	3:44	46.34	20.3	3:50	49.58	20.6
			4: 0	39.52	20.2	4: 6	45.74	20.4	4:10	49.43	20.4
			4:22	38.20	20.2	4:27	45.28	20.3	4:32	48.11	20.5
			4:43	39.41	20.2	4:50	45.14	20.2	4:54	46.70	20.5
			5: 5	40.15	20.2	5:10	43.77	20.2	5:15	47.05	20.3
			5:26	39.67	20.2	5:32	43.67	20.3	5:37	46.22	20.2
			5:48	38.97	20.0	5:53	43.25	20.2	5:58	45.47	20.3
			6: 9	39.34	20.2	6:15	43.38	20.2	6:20	45.14	20.3
			6:31	39.49	20.1	6:37	43.27	20.3	6:42	44.10	20.3
			6:53	38.62	20.2	6:58	42.93	20.2	7: 3	44.08	20.5
			7:14	38.97	20.4	7:20	43.28	20.3	7:25	43.42	20.4
			7:36	38.83	20.1	7:41	42.32	20.3	7:46	44.32	20.3
			7:57	39.06	20.0	8: 3	41.68	20.3	8: 8	43.01	20.3
			8:19	35.28	20.0	8:25	41.26	20.2	8:29	43.05	20.2
			8:41	38.50	20.1	8:46	40.22	20.2	8:51	42.76	20.3
			9: 2	40.88	20.0	9: 7	40.22	20.1	9:13	42.78	20.2
			9:25	40.64	20.0	9:29	39.16	20.0	9:34	42.93	20.1
			9:45	39.46	20.0	9:50	39.12	20.2	9:56	42.67	20.2
			10: 7	39.61	20.2	10:12	39.53	19.9	10:17	43.70	20.2
			10:29	39.31	20.0	10:34	40.33	20.1	10:38	43.74	20.1
			10:50	38.48	20.0	10:55	41.44	20.0	11: 0	44.42	20.2
			11:12	37.38	20.0	11:17	40.77	19.9	11:22	44.90	20.0
11:50	52.08	-4.1	11:33	37.87	19.9	11:38	41.49	19.9	11:44	44.64	20.0
12:11	45.08	20.5	11:55	37.61	20.0	12: 0	41.19	19.8	12: 5	43.99	19.9
12:33	44.10	20.1	12:16	39.34	19.8	12:21	42.08	19.9			
12:55	44.49	20.0	12:38	40.84	19.9	12:43	42.58	20.0			
13:16	43.87	20.1	13: 0	41.55	19.9	13: 5	42.56	20.3			
13:38	45.45	20.1	13:21	44.10	20.4	13:26	42.07	19.8			
14: 0	44.68	20.0	13:43	42.50	20.0	13:48	41.68	19.8			
14:21	44.91	19.9	14: 4	43.38	20.1	14: 9	40.93	19.7			
14:42	44.67	20.0	14:26	41.56	20.2	14:31	42.61	19.7			
15: 4	45.11	20.3	14:48	42.13	20.1	14:52	42.89	19.8			
15:26	39.13	20.2	15: 9	41.73	19.9	15:14	43.11	19.8			
15:47	32.87	20.0	15:31	42.63	20.1	15:36	44.16	20.0			
16: 9	29.87	20.0	15:52	41.66	20.1	15:57	43.64	19.7			
16:30	29.30	19.9	16:14	41.91	20.2	16:19	44.27	19.7			
16:52	29.20	20.1	16:35	43.08	20.1	16:40	45.52	19.7			
17:13	30.25	20.0	16:57	44.47	20.2	17: 2	45.66	19.8			
17:35	32.04	20.0	17:19	46.61	20.2	17:23	47.30	19.9			
17:56	33.00	20.0	17:40	47.21	20.5	17:45	48.19	20.0			
18:18	34.55	20.0	18: 2	47.73	20.5	18: 7	48.12	20.0			
18:39	35.33	20.1	18:23	48.20	20.5	18:28	49.14	20.2			
19: 1	35.23	20.1	18:45	47.33	20.2	18:50	48.93	20.1			
19:23	35.79	20.1	19: 6	48.12	20.4	19:11	50.08	20.3			
19:44	35.65	20.1	19:28	47.27	20.3	19:33	49.66	20.3			
20: 6	36.18	20.0	19:50	46.71	20.4	19:54	50.17	20.3			
20:27	36.86	20.0	20:11	48.39	20.5	20:16	50.14	20.3			
20:50	36.78	20.1	20:33	46.25	20.5	20:37	49.66	20.3			
21:10	36.26	20.1	20:54	47.88	20.4	21: 0	50.43	20.3			
21:32	35.84	20.2	21:16	48.27	20.4	21:20	50.63	20.4			
21:53	35.46	20.1	21:37	49.20	20.5	21:42	50.78	20.3			
22:15	36.30	20.3	22: 0	49.35	20.5	22: 4	51.49	20.4			
22:37	37.00	20.1	22:21	49.53	20.4	22:25	51.04	20.2			
22:58	39.87	20.2	22:42	49.48	20.3	22:47	51.90	20.4			
23:20	40.88	20.2	23: 4	50.10	20.4	23: 8	52.67	20.4			
23:41	41.61	20.3	23:25	49.46	20.6	23:30	53.17	20.3			

These data were collected under file GBT#67

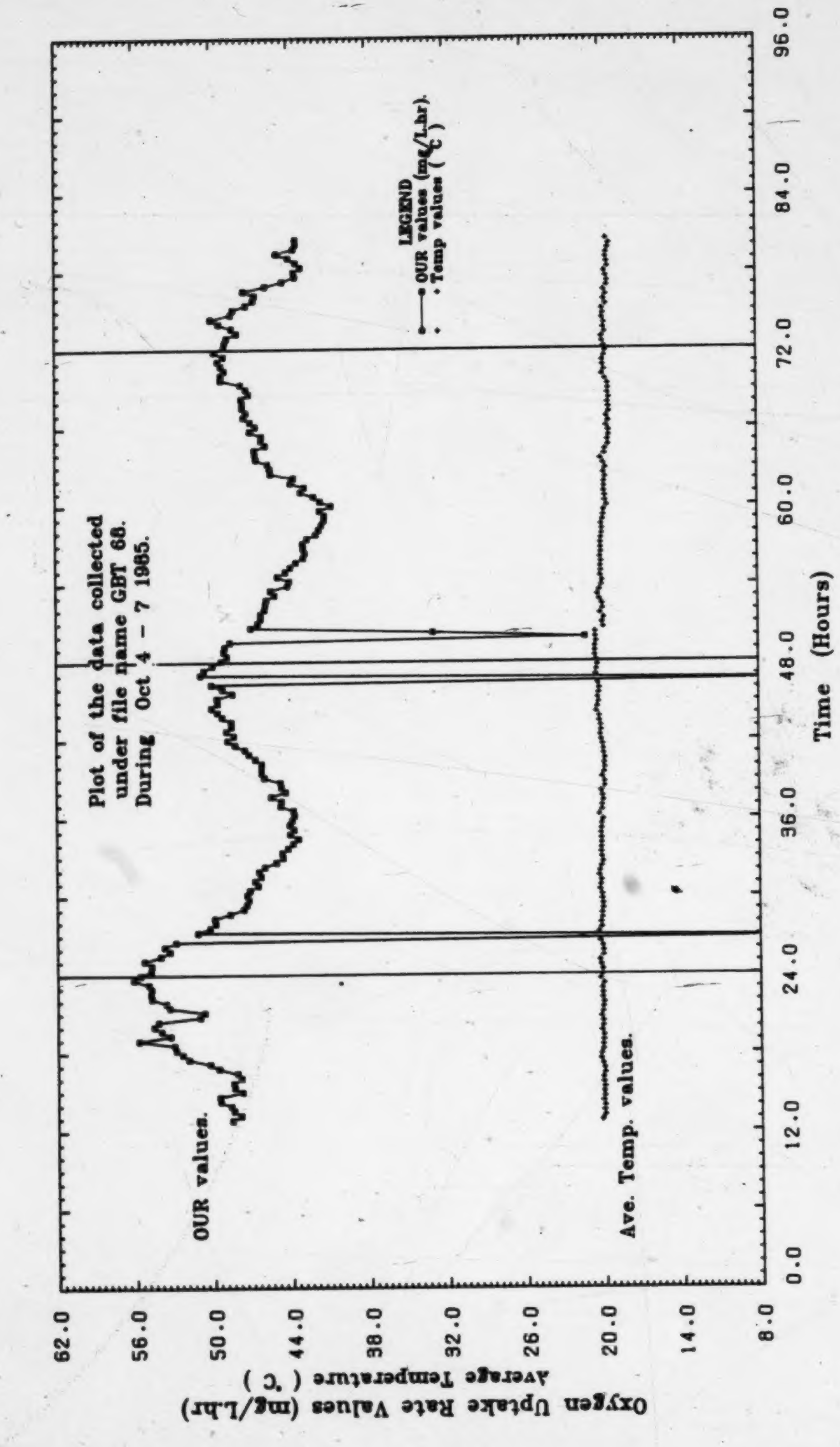


Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

The Results of The Automated
Oxygen Uptake Rate Apparatus.
(For the period of 4- 7 / 10 / 1985)

DAY 1 4 10 85			DAY 2 5 10 85			DAY 3 6 10 85			DAY 4 7 10 85		
TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C	TIME Hr:Min	OUR mg/L.hr	TEMP C
			0:20	54.79	20.1	0: 4	49.28	20.4	0: 9	46.94	19.7
			0:42	54.74	20.3	0:25	48.82	20.6	0:31	46.66	19.8
			1: 3	55.30	20.3	0:47	49.06	20.5	0:52	46.71	19.9
			1:25	54.04	20.1	1: 8	48.87	20.5	1:14	47.95	19.9
			1:47	53.21	20.1	1:30	48.58	20.4	1:35	48.34	19.7
			2: 8	53.75	20.1	1:51	21.30	20.5	1:57	49.32	19.7
			2:30	52.85	20.3	2:13	32.95	20.5	2:19	49.95	19.6
			2:51	1.50	21.7	2:35	46.96	19.9	2:40	46.42	19.7
			3:13	51.14	20.4	2:56	46.41	20.0	3: 2	46.23	19.8
			3:34	50.20	20.2	3:18	46.20	19.8	3:23	47.24	19.9
			3:56	49.77	20.2	3:39	46.19	20.1	3:45	46.86	19.7
			4:18	49.84	20.1	4: 1	45.69	19.9	4: 7	46.84	19.5
			4:39	48.85	20.2	4:23	45.82	20.0	4:28	47.43	19.7
			5: 1	47.60	20.1	4:44	45.75	20.2	4:50	46.74	19.4
			5:22	47.36	20.1	5: 6	45.12	20.3	5:11	44.43	19.4
			5:44	47.19	20.1	5:27	45.43	20.2	5:33	43.46	19.5
			6: 5	47.33	20.1	5:50	44.13	20.0	5:55	43.53	19.6
			6:27	47.12	20.3	6:10	43.99	20.0	6:16	43.01	19.4
			6:50	46.47	20.2	6:32	44.56	20.1	6:38	43.38	19.4
			7:10	46.72	20.2	6:54	44.27	20.0	7: 0	43.85	19.5
			7:32	46.24	20.3	7:15	43.90	20.1	7:21	44.86	19.5
			7:53	46.40	20.3	7:37	43.47	20.0	7:43	43.56	19.4
			8:15	45.95	20.1	7:58	42.69	20.1	8: 4	43.40	19.3
			8:36	45.08	20.0	8:20	42.78	20.0	8:26	43.41	19.5
			8:58	44.55	20.1	8:41	42.80	20.1			
			9:20	44.60	20.2	9: 3	42.93	20.1			
			9:41	44.18	20.2	9:25	42.61	20.0			
			10: 3	43.77	20.1	9:46	41.93	20.0			
			10:25	43.37	20.1	10: 8	41.59	19.9			
			10:46	44.00	20.2	10:29	41.46	20.0			
			11: 7	43.71	20.1	10:51	41.29	19.8			
			11:29	44.01	20.1	11:12	41.26	19.8			
			11:50	43.84	20.0	11:34	41.61	19.8			
			12:12	43.57	20.3	11:56	40.74	19.8			
12:50	48.60	20.2	12:34	43.74	20.1	12:17	41.57	19.7			
13:11	47.93	20.0	12:55	44.73	20.1	12:39	42.07	19.7			
13:33	48.47	20.1	13:17	44.85	20.0	13: 0	43.08	19.8			
13:54	48.69	20.1	13:38	45.43	20.1	13:22	42.60	19.7			
14:16	49.51	20.1	14: 0	44.34	20.1	13:43	43.65	19.6			
14:37	49.57	20.1	14:22	44.65	19.9	14: 5	43.82	19.7			
15: 0	47.53	20.1	14:43	44.73	19.9	14:26	45.39	19.8			
15:20	48.43	20.0	15: 5	45.95	20.1	14:48	45.44	19.8			
15:42	48.46	20.1	15:26	46.16	19.9	15:10	45.60	19.8			
16: 4	47.66	20.2	15:48	46.19	19.9	15:31	46.49	20.0			
16:25	48.19	20.0	16: 9	46.16	19.9	15:53	46.57	19.7			
16:47	49.61	20.1	16:31	46.65	19.8	16:14	46.60	19.7			
17: 8	50.28	20.2	16:53	47.14	19.9	16:36	45.76	19.4			
17:30	51.92	20.3	17:14	47.45	20.0	16:58	46.06	19.4			
17:52	52.38	20.3	17:36	48.21	20.0	17:19	46.06	19.4			
18:13	52.88	20.2	17:57	48.78	20.1	17:41	46.87	19.4			
18:35	53.02	20.2	18:19	48.31	20.2	18: 2	46.54	19.6			
18:56	55.75	20.1	18:40	48.87	20.1	18:25	46.94	19.4			
19:18	53.31	20.1	19: 2	48.48	20.2	18:46	47.43	19.5			
19:40	54.01	20.2	19:23	48.51	20.3	19: 7	47.28	19.3			
20: 1	54.60	20.2	19:45	49.18	20.2	19:29	47.52	19.4			
20:23	54.25	20.1	20: 7	49.55	20.5	19:50	47.54	19.4			
20:44	51.01	20.3	20:28	50.01	20.4	20:12	47.80	19.3			
21: 6	50.67	20.2	20:50	49.54	20.3	20:33	47.04	19.4			
21:28	53.37	20.1	21:11	49.61	20.4	20:55	47.25	19.4			
21:50	53.63	20.1	21:33	48.42	20.3	21:17	47.66	19.4			
22:11	54.75	20.2	21:54	49.17	20.2	21:38	48.16	19.6			
22:32	54.62	20.1	22:16	50.03	20.4	22: 0	49.17	19.9			
22:54	54.77	20.2	22:37	2.55	19.2	22:21	48.90	19.7			
23:15	54.97	20.1	23: 0	50.66	20.5	22:43	49.17	19.8			
23:37	56.14	20.3	23:21	50.80	20.4	23: 4	49.42	19.8			
23:58	55.61	20.1	23:42	49.93	20.4	23:26	48.98	19.7			

These data were collected under file GBT#58



Plot of the Sample's OUR & Temperature Values vs. Their Collection Time at the Gold Bar WW.T. Plant.

APPENDIX F. Operation Manual.

This Appendix contains a detail operation manual, and the setup instructions of the automated oxygen uptake rate measurement system.

User's Manual
# of The Automatic Oxygen Uptake Rate
Measurement Apparatus

I. Introduction

The computerised OUR measurement apparatus is made up of three separate parts; one is the structural unit, second is the computer hardware and software systems, and third is the electrical unit. The electrical unit is instructed by the computer system to carry out different tasks of the OUR apparatus. In this manual a general description of these units and their relation to each other are given. Refer to Figure 1, for the schematic diagram of the units set up. The manual will also describe in detail the steps of how to start the operation of the OUR apparatus, and how to calibrate the DO meter on the apparatus for a more accurate measurement of the dissolved oxygen.

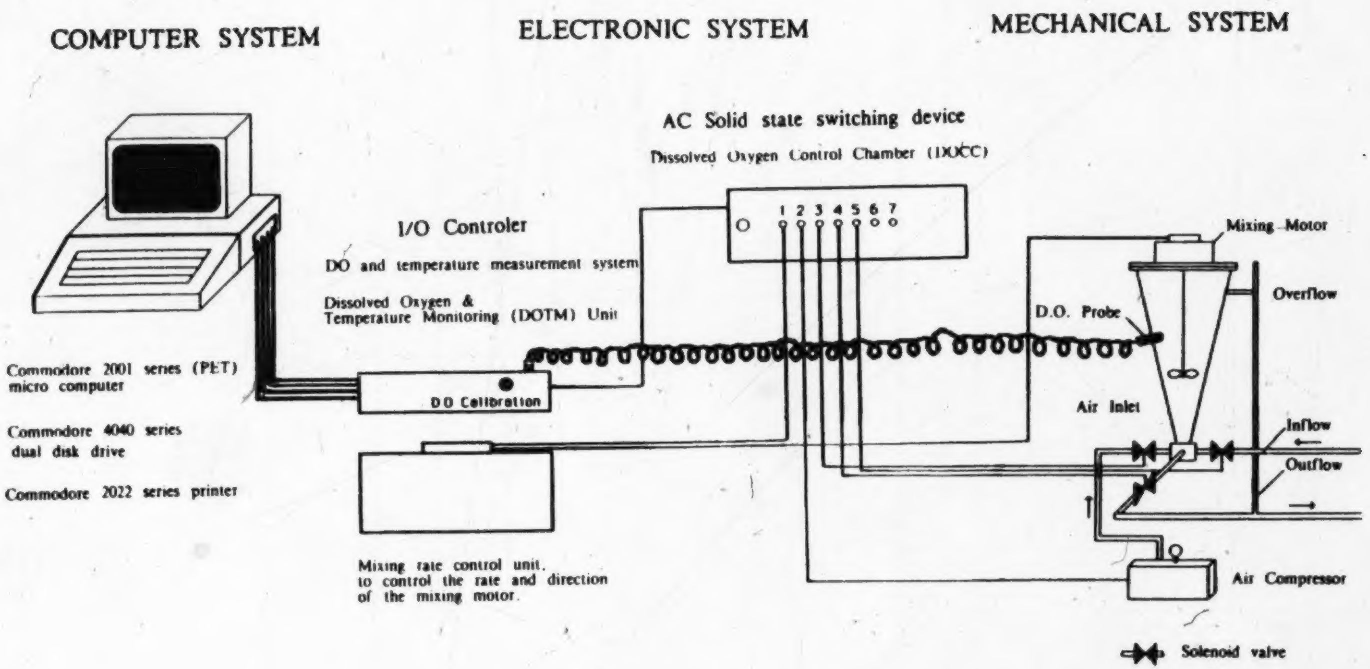

COMPUTER SYSTEM
ELECTRONIC SYSTEM
MECHANICAL SYSTEM
Commodore 2001 series (PET) micro computer
Commodore 4040 series dual disk drive
Commodore 2022 series printer
I/O Controler
DO and temperature measurement system
Dissolved Oxygen & Temperature Monitoring (DOTM) Unit
DO Calibration
Mixing rate control unit, to control the rate and direction of the mixing motor.
AC Solid state switching device
Dissolved Oxygen Control Chamber (DOCC)
1 2 3 4 5 6 7
Mixing Motor
Overflow
D.O. Probe
Air Inlet
Inflow
Outflow
Air Compressor
Solenoid valve

Figure 1. Schematic Diagram of The Systems and Their Relation With Each Other.

II. Description of the Individual Units.

A. Structural unit

The structural unit consists of a cone shaped measurement tank, and three solenoid valves for sample inlet (V1), sample outlet (V3), and an air valve (V2) for sample aeration. The measurement tank and the mixing motor are held upright by a metal stand. The solenoid valves and their respective pipe lines are fastened on a wooden base to give a solid structure shown in figure 2. Two other items which can be considered as a part of the structural unit are the air compressor which provides the air for the aeration of the sample, and the inlet pump which is needed in some locations where the sample has to be pumped into the measurement tank.

Connections of The Structural Unit

There are two types of connections for the structural unit, one is the electrical connections, and second is the pipe and hose connections. The electrical wirings of the solenoid valves, the air compressor, and the inlet pump (if it is needed) are all connected to the Dissolved Oxygen Control Chamber (DOCC) electronic device. The description of this device will be given in later sections; however, the appropiate channel connections on the device for the above mentioned connections are as follow:

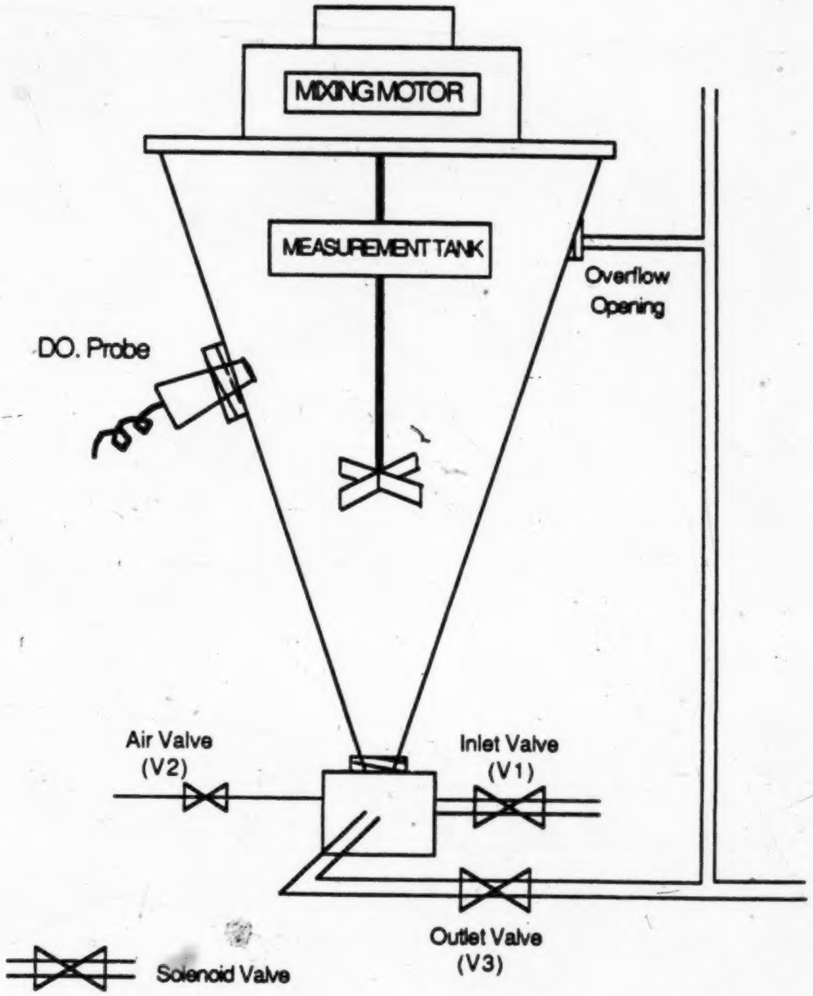

MIXING MOTOR
MEASUREMENT TANK
Overflow Opening
DO. Probe
Air Valve (V2)
Inlet Valve (V1)
Outlet Valve (V3)
Solenoid Valve

Figure 2. The Structural unit

Inlet solenoid valve	Channel 1.
Air solenoid valve	Channel 2.
Air Compressor	Channel 3.
Outflow solenoid valve	Channel 5.
Inflow Pump	Channel 6.

The mixing motor has to be connected to the smaller unit which is attached to the 5 Channel Motor Speed Control system. A general description of this device and its connections will be given in later sections.

The pipe and the hose connections on the structural unit should be connected in the following order. The inlet solenoid valve connects to the sample withdraw location; in the case where the sample has to be pumped into the measurement tank the inlet pump is connected on this line. The air solenoid valve connects to the air compressor or any other source of air supply which is available. The outlet solenoid valve connects to the draining system into which the sample can be discharge. The drain has to be located lower than the sampler for an easy discharge of the sample under gravity.

B. Electrical Unit

Currently there are three electrical devices within the electronic unit which control the operation of the OUR apparatus. These three devices are, the Dissolved Oxygen and

Temperature measurement (DTOM) unit, the Dissolved Oxygen Control Chamber (DOCC) system, and the 5 Channel Motor Speed Control system. The DOTM and the DOCC units were specially designed for the operation of the OUR apparatus and are controlled by the computer system. The 5 Channel Motor Speed Control device is a temporary device which is used to control the speed of the mixing motor. In future designs either a smaller version of this device will be built or the whole device will be eliminated and a constant speed mixing motor will be used.

The 5 Channel Motor Speed Control Device.

The 5 Channel Motor Speed Control device, as mentioned before, is a temporary device which controls the speed of the mixing motor. The significance of this device and the importance of having the control of the mixing motor speed will be discovered from the prelimenary studies of the apparatus, hence resolving the future of the device. The 5 Channel Motor Speed Controlling device has a smaller unit attached to it, which is called the Rotational Control device because it controls the rotational direction of the propellers on the mixing motor. The mixing motor connects to this smaller device. The Rotational Control device has two lines going out from it; one line connects to the back of the 5 Channel Motor Speed Control unit, and the second line connects to the Channel 4 of the DOCC unit.

The 5 Channel Speed Control unit has to be plugged into a power outlet for power supply.

The DOTM Unit.

The DOTM device is a combination of an ordinary DO meter and a sophisticated electronic communications system which receives instructions from the computer and sends information back to the computer. This device is mainly in charge of the DO and Temperature data collection and conveying the measured values to the computer. This device also receives signals from the computer which are to be send to the DOCC unit.

The DOTM device is connected to the PET computer with two ribbon cables. These cables establishes the communication lines between the computer and the device. The DO probe connects to the back of the DOTM device, which can then be inserted into the opening on the cone shaped measurement tank from where the DO and Temperature readings of the sample are taken. A cable taken from the back of the DOTM device to the back of the DOCC device establishes the communecation line from the computer through the DOTM device to the DOCC device.

The DOTM device has to be connected to a power outlet for power supply.

The DOCC Unit

The DOCC device controls the operation of the electrical devices on the structural unit. This device will receive its instructions from the computer to open and close solenoid valves, and to switch on and off the mixing motor, the air compressor, and the inlet pump. Each one of these devices is connected into a special channel location at the back of the device. The seven channel connections of the DOCC unit are as follow:

Channel 1.	Inlet Valve.
Channel 2.	Air Valve.
Channel 3.	Air Compressor.
Channel 4.	Mixing Motor (from the Rotational Control device)
Channel 5.	Outflow Valve.
Channel 6.	Inflow Valve.
Channel 7.	Extra.

The DOCC device is connected to the DOTM device with a cable, this cable establihes the communication lines between the computer and the DOCC unit through the DOTM device. The DOCC device is then plugged into a power outlet for power supply.

C. The Computer Hardware and Software Systems

The Computer Hardware

The computer hardware system consists of a Commodore 2001 Series (PET) micro-computer, and a Commodore 4040 dual disk drive. A printer is not necessary in operating the automatic OUR apparatus; however, it is needed to get a printout of the collected data. It is suggested that the printout of the data be obtained at a different PET set up location, because the printing process ties up the computer and much valuable testing time will be lost.

The PET computer and the disk drive are connected with a cable to setup the communication lines between these two units. The computer is also connected to the DOTM electronic device by two ribbon cables. After these connections are made the computer and the disk drive can be plugged into a power outlet and switched on.

The computer itself is not capable of operating the Automatic OUR apparatus. Instructions must be given to it to communicate with the other units on the apparatus and to proceed with the operation of the apparatus. These instructions come from the operator and the software program which has been designed to operate this apparatus.

The Computer Software

The software program is called the "OUR.OPERATION" program. This program was developed by Bijan Aidun to operate the Automatic OUR Measurement apparatus. The "OUR.OPERATION" program can be broken down into two major parts: one is the interactive instruction collection by the program, and the second is the actual operational program of the apparatus.

The interactive instruction collection of the program is in two versions, a detail questionnaire which is good for beginners to know exactly what type of information is required, and a short version which is designed to speed up the instruction input process. Access to both of these versions is possible at the beginning of the program. A listing of the questionnaires is given in Appendix 1 of this manual. An example run through the questionnaire is also given in this Appendix.

The detail description of the operational portion of the program is not necessary. However, it should be mentioned that the program is capable of running an unlimited number of continuous test runs, and that for each test run one data file is created on the computer floppy disk. The floppy disks can register up to 140 files. To avoid losing any data files the program is designed to automatically switch from one drive to the second drive after every 139 test runs. Note that for this type of automatic switching the first set of files must be stored on the drive number "0". The alterations between the drives will allow the operator to exchange a full disk with a new or empty disk; hence, increasing the storage capacity of the computer. It should also be mentioned that for a continuous set of runs only one file name is needed by the program. The program will automatically add to the end of the original file name the test run number; hence each test run will have a different file name.

III. Setup and Operation of The Automatic OUR Apparatus

It is necessary for the operator to read the previous sections regarding the different units involved in the OUR apparatus and learn the basic purpose of each unit before attempting to operate the apparatus. These sections also generally describe the setup and the connections of the units with each other.

After setting up and connecting all the units on the OUR apparatus, the operation of the apparatus can be started. The following instructions are the step by step directions of how to start the operation of the OUR apparatus. It should also be noted that these directions are to be followed in the case of a power failure which erases all the memory locations of the computer and the operation has to be started from scrach.

Key Notes :

- The operator should type the underline commands into the computer.
- #. Indicates the.pressing of the RETURN key (Do Not type it in).

Starting operation steps.

1. Switch off all the units on the Automatic OUR Measurement Apparartus.
    a) PET computer and the disk drive.
    b) DOTM device.
    c) DOCC device.
    d) The 5 Channel Motor Speed Control device.

2. a. In the case of power failure first remove the disks from the disk drives because by turning the power on without removing the disks the data files and the disk can be damaged.
    b. Switch on the AC Dropout Relay unit which will let the power back into the lines.

3. Switch on the PET computer, then the disk drive.

4. After the disk drive has setteld down insert the Main Floppy Disk into the drive 0 of the disk drive.
    Then type in LOAD"*",8 #.
    Followed by RUN #.
    To load up and run the DOS SUPPORT 4.0 from the floppy disk. This program is a disk operating systems program, and will load up the computer's memory.

5. Type in /OUR.OPERATION #.
    This will load up the "OUR.OPERATION" program.

6. Switch on, in order, the DOTM device, the 5 Channel Motor Speed Control devices, and the DOCC device.
    (The apparatus will then start working and making noise because all the circuits on the DOCC unit are signaled to be turned on. DO NOT PANIC. ! !)

7. Type in RUN #.
This. will run the OUR OPERATION program which is in the computer memory, and it will initiate the DOTM device and the DOCC device by setting up the communication lines between them and the computer.

8. If a volume of wastewater has been collected in the measurement tank as a result of the DOCC circuitry being on for a short time, or in the case of a power failure when the sample was not drained, brake the program and type in POKE 36864,16 #.
This will open the outlet valve on the structural unit and the sample will be allowed to discharge.

9. To store data files on a disk the disk first has to be initialized. Therefore, calculate the number of disks which are going to be used during the continuous operation of the program, and initialize them all at once. (Both sides of a disk can be used by cutting a notch opposite the existing notch.)
To initialize a disk type in >N0:---------,** # and fill in the -------- with a name which you like to give to the disk, and ** with a disk number.

10. When you are ready to start the operation, (have enough initialized data disks) run the OUR.OPERATION program,by typing RUN # .
The computer program always stays on the computer memory unless there is a power failure or when a new program is loaded into the memory.

11. Answer the questionnaire.
The listing and an example run through the questionnaire is given in Appendix 1.
For the calibration of the apparatus also refer to the Appendix 1.

12. To stop the operation during the questionnaire the RETURN key has to be pressed twice; however, during the operation the RUN/STOP key must be pressed to stop the program.

13. To read the data disk's directory,
    type >$0 # if the disk is in drive 0,
    and >$1 # if the disk is in drive 1.

IV. Calibration of The Apparatus

The calibration techniques of the DO meter on the Automatic OUR apparatus are similiar to those of the portable DO meters; hence, for the detail explanation of the techniques refer to the Standard Methods.

The fastest calibration technique of the DO meter on the apparatus is to calibrate it against a calibrated portable DO meter. The portable DO meter first has to be calibrated according to the Standard Methods then taken to the apparatus to be tested against it.

The probe of the calibrated DO meter and the probe of the OUR apparatus are placed together in a flask of water, the water must be mixed at all time to cause a uniform distribution of the Dissolved Oxygen throughout the sample. The measured DO readings of the apparatus are then adjusted with a knob on the DOTM device to agree with the readings of the calibrated portable DO meter.

The questionnaire portion of the OUR.OPERATION program will allow the operator to enter the calibration mode of the program to calibrate the apparatus. In the calibration mode the program will first flash the Temperature readings of the probe on the screen, then by pressing any key on the keyboard the readings will switch to the probe's DO readings. The DO readings can be adjusted to any value by adjusting the knob on the DOTM device. For a detail description of the calibration mode and the step by step directions, refer to Appendix 1.

V. Data Printout Software

Three software program were developed by Bijan Aidun which will allow the operator to obtain a hard copy of the data collected by the automatic OUR apparatus. The means of accessing a data file and the format used by these printout programs, to read a set of data, are compatable with the method in which the data files are stored by the OUR operation software program. This uniformity between the programs will allow access to the stored data files and an accurate readout of the data values. Two of these printout programs are designed to produce a hard copy of the collected data on the Commodore printers, they are the "BA.PRINTOUT", and the "BA.SUMMARY" programs. The third program produces a tabular listing of the data points, and constructs a plot of the calculated OUR values and the temperature measurements of each sample with respect to to the sample's collection time on the University of Alberta's computing system (MTS).

The BA.PRINTOUT program allows the operator to access one or a series of data files at one time to obtain a printout of all the data points and information collected during a specified test run. This program will list all the DO and temperature values collected during the test run; it will also construct a plot of the sample's DO values and temperature values vs. time. The Oxygen Uptake Rate value of a test run is also calculated by the program and printed with the data set.

The BA.Summary program can only access a series of files compiled through a continuous test run. This program reads all the data points in the data file and calculates the Oxygen Uptake Rate (OUR) values of each test run using the Least Squares method and it will also average the temperature values collected during the test run. The program will list all the calculated Oxygen Uptake Rate values and the average temperature values with respect to their sample collection time. A plot of these values with respect to the sample collection time are also constructed by the program to illustrate the OUR and the temperature variations of the samples during the continuous test period.

To operate these programs, the selected program must be loaded on to the computer and ran. The data disks which are to be read by the program, to produce a hard copy, have also to be made available to the program by inserting them into the disk drives; the first data disk has to be inserted into the drive No.0. The instructions and information which are required by the program to access the data files are inputed interactively into the computer. The listing of the questionaire through which the required information are collected for the BA.PRINTOUT and the BA.SUMMARY programs, and an example run throught the questionaires are given in Appendix 2 of this manual. At the end of the questionaire the program automatically accesses the data files and produces a printout.

A. Directions for Loading the Printout Programs

In this section a set of directions are given for loading and running the BA.PRINTOUT and the BA.SUMMARY programs. As mentioned before these programs produce a hard copy of the data collected by the OUR.OPERATION program on the Commodore 2022 printer.

Key Notes :

- The operator should type the underline commands into the computer.

- #. Indicates the pressing of the RETURN key (Do Not type it in).

Loading up the Printout Programs.

1. Switch on the PET computer, the disk drive, and the printer.

2. After the disk drive has settled down insert the Main floppy disk into the drive 0 of the disk drive.
   Then type in LOAD"*",8 #.
   Followed by RUN #.
   This is to load and run the DOS support 4.0 program from the floppy disk. This program is a disk operating systems program. If the computer is already loaded with this program you can proced to the next step.

3. Type in /BA.PRINTOUT # OR /BA.SUMMARY #.
   Depending on the type of output that is required. Refer to the Data Printout Software section of this manual for the detailed description of these programs and their results.

4. Type in RUN #.
   To run the program which has been loaded into the computer, a set of questions are then listed on the screen, one at a time; by ansewering these questions the operator instructs the program to locate the data files and produce a hard copy. The listing and an example run through the questionnaires are given in Appendix 2.

5. Insert the data disk(s) into the disk drive. Note that in the case where there are more than one disk, the first disk must be inserted in drive 0 and the second disk in drive 1, the third disk again in drive 0 and so on.

Recommendations

The following suggestions and recommendations are a result of six months of operating and working with the Automatic OUR Measurement apparatus, and are intended to solve any problems which can arise in the future.

1. First it is recommended that the operator be totally familiarized with this manual, and follow the step by step directions of setting up and operating the apparatus. The operational procedures are carried out every time there is a power failure, and the answering of the questionnaire is done every time the program is stopped; therefore, the operator's ease with these procedures can not be overemphasized.

2. In the initial set up of the apparatus, care should be taken in connecting the electrical attachments because each one plays an important role in the operation of the apparatus.

   Also, it is recommended that all of the power lines of the units be connected to a multiple outlet power strip which is turn in connected to the AC Dropout Relay and then to a power supply. The use of the AC Dropout Relay can prove to be crucial in the case of power failures. A sudden power failure and sudden power excess can be damaging to the disks, and can cause the loss of all the collected data files. This AC Dropout Relay does not let the power back on to the system until the operator turns the unit on after the power failure.

3. In the case of a power failure or any power interruption to the system the OUR.OPERATION program should be reloaded into the computer to guard against any damages which could be caused in the program.
4. The apparatus should be calibrated for DO readings at least every once or twice a week. The DO meter on this apparatus is like any ordinary DO meter and can very easily go off calibration; therefore, a routine calibration of the system is essential.
5. A close eye should be kept on the DO probe. Because of its continuous use, hydrogen sulphide gas is built up on the silver portion of the probe. This can cause an error on the collected data. Therefore, in the case of hydrogen sulphide build up, the probe should be changed and repaired.
6. The apparatus should regularly be inspected to ensure good electrical connections and clean pipe lines.
7. The structural unit of the apparatus should be kept clean at all times. Sludge deposits tend to get built up inside the cone shaped measurement tank, and inside of the copper pipings of the apparatus. Therefore, regular maintenace and cleaning of the apparatus with a strong chlorine solution is recommended. The apparatus should be washed at least once every three to four weeks.

Appendix 1.

In this Appendix, a listing of both the detailed and the short versions of the OUR.OPERATION program questionnaires are given. Some parts of the questionnaires are common to both versions; therefore, only one listing of these parts is made.

By running the OUR.OPERATION program these questions are listed on the PET computer screen one by one, in the same order as they are listed here. The answer to each question has to be typed, and then entered into the computer by pressing the RETURN key before the program can continue to the next question. An example run through the questionnaire and directions to calibrate the DO meter on the automated OUR apparatus are given in the latter section of this Appendix.

Listing of The OUR Operation Program Questionnaire

The common portion of the questionnaire.

Will the required information be given
on the screen or read from a data file ?

What is the date today?
Give the information as day/month/year.
i.e. 9/Jan/85 as 090185. ?

Time of the day in 24-hr clock ?
i.e. for 1:45 pm. type 134500 ?

Any comments for future reference ?

Do you want to calibrate
the DO meter on the apparatus ?

*IF you want to calibrate the meter,
the calibration mode can be entered.
Refer to the end of this Appendix.*

Do you want
the questions in short or detail ?

The detailed version of the questionnaire:	The short version of the questionnaire:
NOTE: Activated sludge will automatically be pumped into the sampler. The aeration and mixing of the sample will also start automatically and continue as long as required. DO and Temp readings will start as soon as the sampler is full. Collected data are stored as long as you require.	
How many minutes will it take to fill the sampler ?	Time to fill the sampler .... min ?
How many minutes do you want to aerate the sample ?	Aeration time .... min?
How many minutes do you want to monitor the sample (Total test time)?	Total test time ...... min ?
How many minutes do you want to mix the sample ?	Mixing time .... min ?
How frequently, in seconds, do want the DO readings ?	DO readings every .... sec ?
How frequently, in seconds, do you want Temp readings ?	Temp readings every .. sec ?

The commen portion of the questionnaire.

What do you want to do for the next run ?
1) Continue with the same data.
2) Change the data.
3) Stop the program.
Type in the appropriate number ?

If number 1 is typed ....
The next question is asked,
otherwise continue to the proceeding questions.

How many times should the
test be run with the same data ?

Under what file name do you
want the data stored ?

Which disk drive is
the data disk in ?

NOTE: for continuous run the first
disk has to be in drive #0.

How many data files do you
want to store on the first disk ?

Have you calibrated the DO meter
for temperature and pressure ?

IF you want to calibrate the meter,
the calibration mode can be entered.
Refer to the end of this Appendix.

A summary of the input information
will then be given.

Do you want to
change the input informations Y/N ?

If a change is necessary
the program will go back to the data input section.
If not the operation will begin.

Example run through the OUR.OPERATION program questionnaire

An example run through the short version of the OUR.OPERATION program questionnaire is listed in this section. The short and the long versions of the questionnaire are very similar and by understanding this example run there should be no problem in operating the apparatus.

The DO meter of the OUR apparatus has also been caliberated in this example run. For the details of the caliberation techniques refer to the next section of this Appendix.

Key Notes:

- After typing in the answer to each question, the RETURN key must be pressed to register the answer.
- If the RETURN key is accidently pressed more than once in this mode the program will stop; however, by typing in CONT the program will proceed from where it was stopped.
- To stop the program during the questionnaire stage the RETURN key has to be pressed two or three times. However to stop the program during the operation the RUN/STOP key has to be pressed.

Questions. / *Answers.*	Comments.
Will the required information be given on the sreen or read from a data file ? *Screen*	- Readout from a data file is not possable as of yeat.
What is the date today ? Give the information in day/month/year i.e. 9/Jan/85 as 090185 ? *190685*	- This information is to be saved with the data files for future reference.
Time of the day in 24-hr clock ? i.e. for 1:45 pm. type 134500 ? *091200*	- Make sure you include the seconds as well.
Any comments for future reference ? *Example*	- Comments can not be more than one line.
Do you want to calibrate the DO meter ? *Yes*	- For the details of the caliberation techniques and use of the caliberation mode of the program refer to the next section of this Appendix. If you do not want to calibrate the apparatus, type in NO for the program to continue.
Do you want the questions in short or detail ? *Short*	- The detailed version of the questionnaire is very much the same as this example. For the listing of the detailed version, refer to the first section of this Appendix.

Questions. / *Answers.*	Comments.
Time to fill the sampler, .min ? *1*	
Aeration time, ... min ? *4.1*	
Total test time, ... min ? *20*	
Mixing time, ... min ? *20*	
D.O readings every, ... sec ? *30*	
Temp readings every, ... sec ? *240*	- **Note all the input units.** - The temperature readings are in seconds and they should not be more frequent than one every 120 sec (2 min).
Under what file name do you want the data stored ? *TEST*	- Only one file name is required even if a set of continuouse runs are to be operated. The program will automatically add the run number of each test to the end of the given file name. For example in this case for run number one a file TEST 1 and for run number two a file TEST 2 will be created to store the data.

Questions. / *Answers.*	Comments.
What do you want to do for the next run ? 1) Continue with the same data. 2) Change the program. 3) Stop the program. Type in the number ? *1*	- By typing number 2, after one run the program will stop, give a summary of the operation which was completed, and go back to the questionnaire to collect new instructions.
How many times should the test be run with the same data ? *72*	- This question will only appear if the answer to the previous question was 1.
The data file will be named TEST 1 through TEST 72	- This information will then appear on the screen. For the program to proceed any key on the keybord can be pressed.
NOTE : for continuous run the first disk has to be in drive #0	
How many data files do you want to store on the fist disk ? *95*	- The number of files on the first disk depends on the number of files which are existing on the disk already. - Knowing that a disk can only store 140 files, if you have 45 files on the disk already then you can only store 95 more files on that disk. - There will be up to 140 files stored on the second disk.

Questions. / *Answers.*	Comments.
Which disk drive is the data disk in ? *0*	- If it is intended to run more than 139 tests the data disk should be placed in drive "0" to start with. Each data disk is capable of registering up to 140 files, and the program is designed to swich from drive 0 to drive 1 to start with and continue to swich from one drive to the other as long as is required.
Have you calibrated the DO meter for Temperature and pressure ? *Yes*	- If the calibration has not been done the program will enter the calibration mode for the operator to calibrate the DO meter. Refer to the end of this Appendix.

```
Summary of the input information:

Time to fill the sampler. . 1.0 min
Aeration time . . . . . . . 4.1 min
Mixing time. . . . . . . . 20.0 min
Monatoring time. . . . . . 20.0 min
DO readings every. . . . . 30.0 sec
Temp readings every . . . 240.0 sec

Data will be stored under file name . . TEST
Disk drive # 0 will be used.

*** DO meter has been ***
****** calibrated. ******
```

Questions. / *Answers.*	Comments.
Do you want to change the input data ? *NO*	- If the input data has to be changed the the program will go back to the start of the instructions input.

With the last confirmation that the input data are all correct, the program will proceed to operate the apparatus as it has been instructed.

Calibration of The DO meter on the Apparatus

The technique of calibrating the DO meter on the apparatus has been described in Chapter IV of the OUR Apparatus User's manual. There are two occasions during the questionnaire of the OUR.OPERATION program when the calibration of the DO meter is possible (refer to the listings of the questionnaire, or the example run through the questionnaire). In both instances by properly answering the questions the program will enter the caliberation mode.

In the caliberation mode first the measured temperature values by the probe are flashed on the screen until the operater presses any key of the PET computer to proceed; next the DO readings are flashed on the screen. The DO readings of the probe may be fluctuating to start with; however, they will settle down. The DO measurements can then be calibrated by adjusting the knob on the DOTM device to the desired reading. After this adjustment has been completed, again any key on the PET computer can be pressed to proceed the program. At this stage the program will ask the operater if he/she wants to look at the caliberated values. If the the answer to this querstion is YES, the program will return to the caliberation mode and the apparatus can be adjusted again; if the answer is NO, the program will then proceed to the next stage.

Appendix 2.

In this Appendix, a listing of the questionnaires for both the BA.PRINTOUT and the BA.SUMMARY programs are given. By loading these programs into the computer and running them one at a time , a set of questions will appear on the computer screen which will allow the operator to instruct the program to locate the data files and produce a printout. An example run through these questions is also given at the end of this Appendix.

Questionnaire listing of the Data Printout Programs

Questionnaire listing of the BA.PRINTOUT program.

```
Do you want to look at
the disk directory Y/N?

How many continuous runs
do you want the data for?

Was the data stored under
1. Different file names ?
2. String of file names ?
Type the appropriate number?

Under what file name
is the data stored?

Note that the first disk drive
has to be in drive #0.

which disk drive is the data disk under?

How many of the data files
are on the first disk?

Summary of the Input Information

Data is stored under. . . . . ---
The disk is in drive. . . . . . -

Do you want to change Y/N?
```

Questionnaire listing of the BA.SUMMARY program.

```
Do you want to look at
the disk drive directory Y/N?

Under what file string name
is the data stored?

How many continuous runs
do you want the data for?

Note that the first disk drive
has to be under drive #0.
Which disk drive is the data disk in?

How many files are there
on the first disk drive?

Summary of the Input Information

**Data is stored under the file name ----.
**There will be -- data files read.
**The disk is in drive --.
**There are -- files on the first disk.

Do you want to change the input Y/N?
```

Example run through the PRINTOUT programs questionnaire

An example run through the BA.PRINTOUT and the BA.SUMMARY questionnaire are listed in the following sections.

Key Notes:

- After typing in the answer to each question, the RETURN key must be pressed to register the answer.

- If the RETURN key is accidently pressed more than once in this mode the program will stop; however, by typing in CONT the program will proceed from where it was stopped.

- To stop the program during the questionnaire stage the RETURN key has to be pressed two or three times. On the other hand, to stop the program during the operation the RUN/STOP key has to be pressed.

An example run through the "BA.Printout" Program questionnaire.

Questions / *Answers.*	Comments.
Do you want to look at the disk directory Y/N? *NO*	- In the case when you would like to look at the directory type in YES.
How many continuos runs do you want the data for? *95*	- Depending on the number of data files you want the detail data printout for. The operator can get a printout for one file, a number of files with different names, or a series of files with an increasing suffix number. If a number 1 is inserted, the program will only ask for one file name and the disk drive number where the file can be located. - If a number greater than one is inserted the questionnaire will follow as listed.
Was the data stored under 1. Different file names 2. String of file names Type the appropriate number? *2*	- If number 1 is typed the program will ask for 95 different file names. In this case the full file name must be given.

Questions / *Answers.*	Comments.
Under what file name is the data stored? *TEST*	- In the case where we have directed the program we like a printout for a series of files, only the original file name must be given. The program will automatically look for files Test 1 through Test 95.
Note that the first disk drive has to be in drive #0.	
How many of the data files are on the first disk? *75*	- The number of files on the first disk is flexible; however, the program will look for up to 140 files, if necessary, on the second disk which must be inserted in drive #1, then it will look for another 140 files on the disk in drive #0 and etc.
Which disk drive is the data disk under? *0*	
Summary of the Input Information	
Data is stored under. . . . . TEST The disk is in drive. . . . . . #0	
Do you want to change Y/N? *NO*	- The program will start looking for the data files and producing a printout.

An example run through the "**BA.Summary**" Program questionnaire.

Questions / *Answers.*	Comments.
Do you want to look at the disk drive directory Y/N? *NO*	- In the case where you would like to look at the directory type in YES.
Under what file string name is the data stored? *TEST*	- This programa is designed to access only a string of files which have been created through a continuous run off the OUR apparatus. The program calculates the OUR values and the average temperature of each test run and plots them against their collection time. The original file name only is needed (no numercal suffix).
How many continuous runs do you want the data for? 95	

Questions / *Answers*.	Comments.
Note that the first disk drive has to be under drive #0.	
Which disk drive is the data disk in? *#0*	
How many files are there on the first disk drive? *75*	- The number of files on the first disk is flexible, however, the program will look for upto 140 files, if necessary, on the second disk which must be inserted in drive #1, then it will look for another 140 files on the disk in drive #0 and etc.
Summary of the Input Information **Data is stored under the file name TEST. **There will be 95 data files read. **The disk is in drive #0. **There are 75 files on the first disk.	
Do you want to change the input Y/N? *NO*	- The program will start looking for the data files and calculating the OUR and average temperature values.